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VIEWS, NEWS AND INTERVIEWS.

A student in a well known technical college, when asked how to make a steam engine run in the opposite direction, told the professor to "connect the steam to the exhaust pipe."

"Few people outside of Savannah are aware that the city possesses a most unique manufacturing establishment, the only one of its kind in the world, where cotton seed oil is manufactured by a secret process into rubber—not a substitute, but *bona fide* (*sic*) rubber; such, at least, some of the best experts have pronounced the product of the factory to be. Nobody knows anything about what is going on inside the factory, with the exception of a very few ignorant negroes. Nobody is admitted. The bare facts alone are known that crude cotton seed oil from the oil mill, costing about 50 cents a gallon, or about $135 per ton, is carted in five-ton lots, and that tons of rubber, worth about $1 per pound, or $2,000 per ton, are carted out and shipped to a rubber dealer and manufacturer of Boston." The discovery of the process is said to have been made by "an artist of some prominence," and is so simple that it is impossible to obtain a patent for it; hence it must be kept secret. There is one consoling reflection about this news, and that is, if it is true, there won't be quite so much cotton seed oil sold as a substitute for olive oil; but it is advisable to await developments. The New York *India Rubber World* says that "in case this product should prove of value, it can be made very cheaply."

Gutta-percha was first introduced into Europe from Malaga in 1852. The annual consumption now amounts to 4,000,000 pounds.

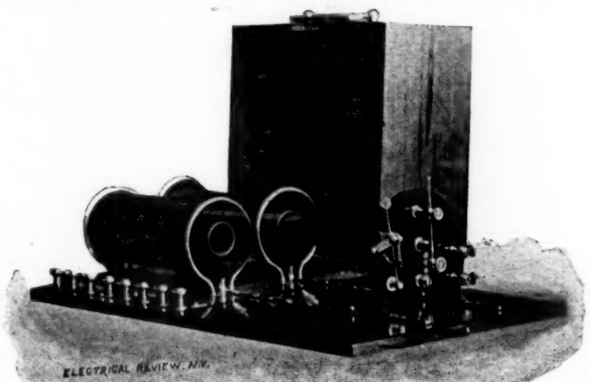
It is well known that opaque globes absorb a very large amount of the light of arc lamps, and whatever present style of globe is used, a dark shadow is cast below the lamp. To avoid these difficulties a new style of globe has been brought out in France made of transparent glass, with circular depressions having such faces as to form lenses (similar to the well-known lighthouse lenses), the curvatures of which are so calculated that they refract and reflect so as to diffuse the light. Such globes may be made of pressed glass, and, although more expensive, they diffuse light much more economically than absorbing opal or ground glass globes.

Orange, Mass., has the distinction of being the only town in the State, of 5,000 or more inhabitants, without some kind of a fire alarm system. Now is the time. It is never too late to mend.

It is reported that the Edison Electric Light Company, of Philadelphia, proposes to spend $5,000,000 in laying conduits and underground conductors.

Electric Power has been purchased by McIlroy & Emmet, and will be published hereafter at 36 Cortlandt street, New York city, as a high class monthly, dealing with the interests indicated in its title.

A new switchboard and distributing board are being established in the Jamestown, N. Y., telephone exchange, with a capacity of 1,000 names. The business of the New York & Pennsylvania Telephone & Telegraph Company in Jamestown is increasing so rapidly as to warrant the heavy outlay; besides, the company desires to accommodate the rapidly lengthening list of long distance subscribers, who demand superior service. The company has in construction long distance lines between Jamestown and Elmira and Jamestown and Warren. Superintendent Stearns is one of the most progressive and enterprising men in the telephone business, and is bringing the service in his district to a high state of efficiency.



HIGH TENSION COILS FOR GYNÆCOLOGICAL WORK.

The Honor of Draftsmen.

At this writing much space is being devoted in some of the papers to a rather sensational account of the alleged purloining of the drawings of one prominent electrical company by another, this being supposed to be accomplished by the treachery of a draftsman, who, while ostensibly in the employ of one company, was much more in the employ of the other.

The stealing of drawings and plans, in order to take an unfair advantage in business competition, is a particularly disreputable business, and we sincerely hope that whoever may be found guilty of doing it—or of being in any way concerned in it—will be justly punished, whether he be a poor and obscure agent or a wealthy and influential principal.

We hope, however, that it will turn out that no draftsman has been concerned in this, for it is particularly disgraceful for a draftsman to engage in any such business. The position of a draftsman is, and of necessity must be, a confidential one in nearly every case, and it ought to be considered a very gross breach of trust and confidence for a draftsman to let a drawing belonging to his employer, or any information which might be used to his disadvantage, go out in such a way that a competitor could take any advantage of it.

But, on the other hand, it should be remembered by those who employ draftsmen that the position is a confidential one, and the wages paid and other attractions offered should be such that the class of men who can be trusted will be attracted. The employer who is determined to pay the very smallest wages that will secure men of any kind, must expect to get once in a while men who cannot be much relied upon, for men of proven high character, combined with the needed ability, can usually do better. We do not mean by this that the wages paid in the case mentioned were insufficient, but it would not be fair to call attention to the fact that a draftsman who betrays his employer is especially despicable, without also calling attention to the fact that the wages paid for a position of responsibility and trust should be commensurate with the responsibility and the degree of confidence reposed.

It is quite certain, of course, that neither the General Electric, the Westinghouse, nor any other company, can possibly pay any draftsman enough to make it really worth a draftsman's while to commit a breach of trust and confidence. Character and reputation are worth far more than any amount which any company can possibly pay for such a service, and it is quite certain that even the company which hires such work done will, after that, despise and distrust the man who does it for them. Breaches of trust are very rare among draftsmen. We hope they will continue to be so.—*American Machinist.*

High Tension Coils for Gynecological Work.

These coils as constructed by the Jerome Kidder Manufacturing Company, of New York, are composed of Nos. 21, 32 and 36 copper wire, double insulated and carefully selected, wound upon two spools as follows:

The back spool consists of about 700 feet of No. 21 wire, topped at about one-third the length, giving three variations from coils as follows: First section, 240 feet; second section of 460 feet, and a combined length of both equal to 700 feet of No. 21 wire.

The second or front spool contains two diameters of wire, Nos. 32 and 36. The first section of No. 32 wire contains 1,038 feet; the second section contains 1,590 feet. The combined length of both sections of No. 32 wire contains 2,628 feet, producing three variations of tension. The second coil, wound upon the same spool with the No. 32 wire, and in contact with it, consists of No. 36 wire in two sections, as follows:

The first of 1,320 feet; the second of 3,063 feet. These sections in combination contain a length of 4,383 feet, producing three variations. One modification of the apparatus is, that one can combine any two of the various sections of No. 32 or 36 wire; or, elect into the circuit the total length of both entire coils.

The combinations would be represented as follows: No. 32 wire, 1,038, 1,590, 2,628. No. 36 wire, 1,320, 3,063, 4,383. No. 32 wire, total length with additions of No. 36, as follows: 3,948, 7,011 feet. One can readily appreciate that eight modifications in the length and changes can be made with the fine wire coils.

By this arrangement the two secondary helices are fixed, and the primary circuit is wound at will. The current can be increased from nothing to any desired degree by introducing the primary field. It is movable upon a rail, and so constructed that it can be lifted out and placed into either spool at will. The head plate of the primary circuit contains a circuit breaker with means for controlling the brake, from a medium to a very rapid, as well as a slow circuit breaker for pulsations. The coils are mounted either upon a rubber base, or placed in a portable case, similar to that shown in the illustration herewith. The platform of the box is hinged at the center and folds under the base to which the coils are attached, the box turned down and locked making a very compact apparatus.

OBITUARY.

Mr. A. W. Meston, of the Emerson Electric Manufacturing Company, St. Louis, died of consumption on May 12, after a lingering illness. Mr. Meston is known as the inventor of the alternating current fan motor bearing his name and made by the company with which he was connected. He was a close student and had been a careful experimenter with alternating currents and motors.

A New Wimshurst Influence Machine.

Mr. Wimshurst's untiring activity in the cause of electrical science has brought about the construction of another influence machine, differing entirely in construction and method of working from the type with which his name has hitherto been associated, we learn from London *Engineering*. From the illustration on this page it will be seen that the new machine consists of two discs of plate glass, each three feet five inches in diameter and one-quarter inch in thickness, mounted on one boss and spindle, about three-quarters inch apart. This spindle is driven by a handle, and the discs rotate in one direction. Within the space between the two discs are fitted four vertical slips of glass, two being situated on the right-hand side of the machine and two on the left. The vertical edges of the slips which come nearest the spindle are cut to an angle of 15 degrees, radially; each of the two discs, therefore, is covered by the slips for nearly three-quarters of its surface. Upon each slip is a paper inductor, and on its leading edge a brush, the brush and the paper inductor being metallically connected together. These brushes are of fine wire, and touch lightly upon the inner surfaces of the discs. The glass slips are held in place by grooves at their top and bottom ends; they may be removed or replaced easily at pleasure.

The outer surfaces of the discs are also touched by brushes. Two brushes to each disc take the place of the usual collecting combs and obtain the charges for outside use, while two other brushes remove the remaining portions of the induced charges, the transference being from one half of the plate to the other half.

These essential parts of the machine are fitted together within a glass case, and in every way the machine is so constructed as to be useful for experimental purposes. Owing to the large size of the discs and the necessarily limited dimensions of the case, the distances between part and part are small, and the length of the sparks is limited by the insulating distances.

All the glass under excitement is coated with shellac, and when the surfaces are in good condition, and the brushes new and in proper position, the machine is self-exciting, and quickly obtains its maximum value. The direction of the electrical flow does not change even when the terminals are opened beyond striking distance; the whole of the charges then pass by way of the neutralizing brushes and circuit. When, however, the neutralizing circuit is also broken, the electrical charges are not reduced, but then they change from positive to negative with each half revolution of the discs.

As an approximate measure of the efficiency of the machine, the following experiments have been made:

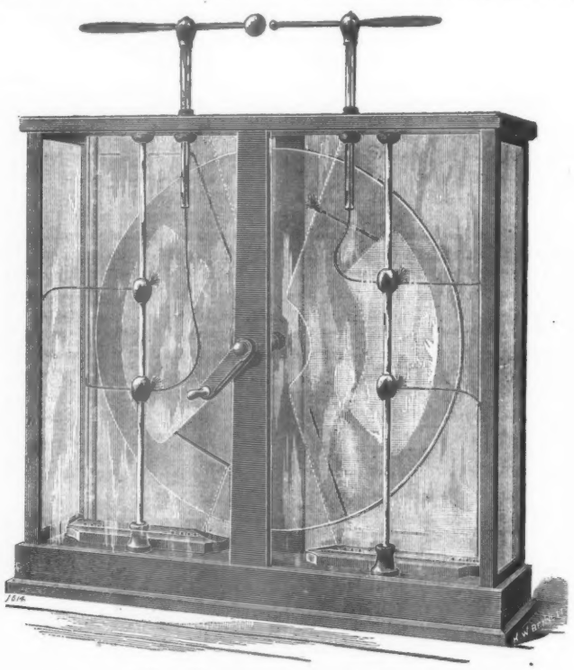
The glass throughout was held free from electrical excitement, and the discs were rotated 60 times per minute. The actuating cause was then removed and the discs left to come to rest; they did so after completing 47 revolutions. This may be accepted as the measure of the friction of the journals and the brushes.

The discs were then similarly treated, but the electrical charges were allowed to form, when it was found the discs came to rest after completing 23 revolutions. The friction of the machine is, therefore, about equal to the electrical resistance (or the repulsion of the electrical charges).

Leyden jars, each having eight square inches of tinfoil, were then connected to the terminals, and the terminals set three and a half inches apart. The discs were then turned to the same number of revolutions and left to come to rest, which they did after producing 80 sparks of three and a half inches in length.

The discs were then steadily turned, and the numbers of sparks of several lengths were counted in relation to the rotation of the discs. This showed that for each revolution seven sparks of one inch length, five of two inch length, four of three inch length and three of four and a half inch length were produced.

Eight metal sectors (area 14 square inches in each) were then added to each disc. With them the self excitement becomes so free that, before any circuit whatever is made, merely presenting a finger to the rotating disc causes an electrical discharge. When the circuits are made between the several brushes the plates appear to glow with electricity, and electrical charges shoot out for a large part of the circumference of the discs. These discharges may be heard for some distance, and remind one of the beating of the floats of a paddle-wheel. The display is, however, wasteful; the amount of waste may be measured by the fact that the discharges at the terminals are less by 25 per cent. than when the discs have no sectors upon them. When a pulley three inches in diameter was fitted to the spindle, and a weight of 15 pounds was suspended therefrom by a cord, the fall of the weight through three feet produced 17 revolutions when no excitement was present, and only 10 revolutions when excitement was present. The same Leyden jars were then connected, and it was found that the fall of the weight through the three feet produced 28 sparks of three and a half inches in length. Reducing this to the terms of work done in relation to the spark length, it will be seen that one pound weight falling through rather less than 12 inches produces one spark of three and a half inches in length. It must not, however, be forgotten that a considerable amount of electricity is also passing by the neutralizing brushes and circuits—at least as much as by the terminals; this amount has not yet been measured.



A New Wimshurst Influence Machine.

The method of working of Mr. Wimshurst's very popular original machine, which is now to be found in all science schools and colleges, is a subject on which differences of opinion exist. The same may probably be said of the present machine. The following theory, however, seems to satisfy the conditions, and is the one followed by Mr. Wimshurst himself. As the machine starts without any artificial excitement, it is evident that there must be a difference of potential between the discs and the plates at all times, due to the differences that exist in the atmosphere. Let us assume that the discs revolve in the direction of the hands of a watch, and, following one disc, imagine a small positive charge upon it just above the fixed glass slip on the left-hand side. This charge will be carried forward until it reaches the brush attached to the fixed slip on the right-hand side; immediately this charge will diffuse itself over the paper inductor, leaving a free positive charge on the face of the disc in the neighborhood of the inductor. This charge will be caught by the upper brush, on the glass rod, and delivered to the terminal above. Any remaining charge will be carried forward to the lower brush and delivered to the neutralizing circuit, which is connected by a wire in the base of the case to the upper brush on the glass column on the left of the machine. This brush is in contact with another part of the disc, and thus imparts to it a positive charge ready to be carried forward as described. The part of the disc leaving the inductor on the right-hand side carries on its face a negative charge, which plays the same part in relation to the left-hand inductor as that we have already described, and imparts a negative charge to the terminal ball on the left of the machine.

This machine is likely to be exhibited shortly to the Physical Society, of which body Mr. Wimshurst is a Member of Council.

TELEPHONE CHAT.

The telephone line connecting Grand Island, Aurora and York will soon be put up.

Local Manager Keating, of the Southern New England Telephone Company, at Ansonia, Conn., has ordered the discharge of all union men as the result of the strike at New Haven.

A contract has been entered into with the Sunset Telephone and Telegraph Company for a police alarm system for Tacoma, Wash., for one year, from May 1. The system is to have 15 stations, at a total cost of $225 per year.

The Providence Telephone Company has begun the work of laying its wires underground. Under direction of Assistant Superintendent McClellan 318 feet of trenches have been dug and over 1,500 feet of ducts laid from the corner of Plain and Point streets. The trenches are about four feet deep and situated midway between the water pipe and the curbstone. The ducts are laid five in a row, and each duct is equal to a capacity of 1,000 wires.

The annual report of the Erie Telegraph and Telephone Company for the year ending March 31, 1893, shows for its three controlled companies, the Cleveland Telephone Company, Northwestern Telephone Exchange Company and the Southwestern Telegraph and Telephone, gross earnings of $941,813, an increase of $75,479. The surplus is $35,707, an increase of $8,226. Net earnings are $31,295, an increase of $10,938. The Erie balance sheet shows total assets of $5,482,507, an increase of $196,681.

ELECTRIC RAILWAY AND POWER NOTES.

Brainard, Minn., has a new line of electric railroad, three miles and a half in length, the completion of which was celebrated last week.

President Adams, of the Cataract Construction Company, states that the company has entered into a contract with the Cataract Electric Company, of Rochester, by which it is to furnish that company with 10,000 horse-power as soon as developed.

The storage battery street railway bill has passed the Massachusetts House by a fair majority, and it is not likely that the pending motion to reconsider will cause a reversal of action. The house is not feeling friendly toward the West End Railway, and to this fact is largely due the favor it has shown to the storage battery interest. It is stated that a strong effort is to be made in the senate to defeat the bill.

Mr. W. B. Rankine, secretary and treasurer of the Cataract Construction Company, is reported as saying: "No matter what argument the competing companies get into, it will not in any way alter our plans nor the time of our decision on the question. Everything will move along in its accustomed steady manner, and the decision of the company will be given in due time and without any reference to any fight between the several companies."

The train house and power house of the Grand View Beach Electric Road, which runs along the lake shore at Rochester, N. Y., for several miles, were burned to the ground last week. Thirteen out of 14 cars, 500 tons of coal stored in for the summer traffic and all the tools and appliances were destroyed. The loss is $60,000, but is covered by insurance. The summer's business will be lost, and that means a total loss, for the reason that the road is purely a summer road.

A syndicate was formed in this city last week with a capital of $4,000,000 for the construction and equipment of a transmission line between Niagara Falls and Albany, for the transmission of electric power generated by the waters of the Niagara river passing through a great number of wheel pits from an enormous tunnel which has just been completed, 8,000 feet in length and 24 feet in diameter. The route along which the transmission line will be laid has not been fully determined upon.

A committee representing the striking linemen called upon President Lewis, of the Brooklyn City Railroad Company, at his office in Montague street, last week, relative to the demand made by the strikers for an increase of wages from $2.50 to $3 per diem. President Lewis advised his visitors that he had given the matter careful attention, and that it would be impossible for him to establish a $3 per diem rate, for the reason that he did not think the skill necessary for the work warranted that rate of pay.

A correspondent writes: The statement that all records were broken by the New York Central's new Columbian engine on May 9 is, I think, inaccurate. The speed credited to that engine is 112½ miles an hour. In the National Museum in Washington may be seen an electrical motor designed and patented by David G. Weems, of Baltimore, which has a record of 120 miles an hour, made on an experimental track under unfavorable conditions near the home of Senator Arthur P. Gorman, at Laurel, Md.

The haulage system in operation at the Brock mines is one of the first of its kind ever perfected, and the plant is used as an example of the successful application of electricity to coal mining. The Thomson-Houston Electric Company, which put in the plant, constantly refer the Brock mines to operators wherever they endeavor to introduce the system. Consequently the mines are visited by coal men from far and near. The last mule was taken away from the Brock mines this week. All the hauling, both inside and outside the mines, is done by electricity. Two motors are employed, which go in and out of the mines as occasion demands. The longest haul is 5,100 feet.

Edison Fixture Patents.

AN IMPORTANT DECISION.

The Edison Electric Light Company recently sued the Equitable Life Assurance Society of the United States for alleged infringements of patents Nos. 251,554 and 318,424, both granted to Thomas A. Edison for improvements in sockets and fixtures. Recovery for infringement by the users was denied to the complainants by Judge Coxe, who on May 8 handed down the following decision:

UNITED STATES CIRCUIT COURT. SOUTHERN DISTRICT OF NEW YORK.

Edison Electric Light Company, *et al.*, *vs.* The Equitable Life Assurance Society of the United States.

In Equity. On bill and plea alleging laches and acquiescence in defendant's alleged infringement for 11 years. Eugene H. Lewis, for complainants; Leonard E. Curtis, for defendant.

COXE, *J.*: The defendant asks by the plea to have the bill dismissed on the ground of laches. No authority for this practice in an infringement suit is cited by counsel. There is no doubt, however, that the defense of the statute of limitations may be presented by plea. 2 Dan. Ch. Pl. & Pr. vol. 2. 28; Story Eq. Pl. Sec. 757. It has also been held that a party, who for 40 years has been in peaceable possession of premises sought to be recovered, could present the question of laches by a plea. Hewett *vs.* Thomas, 2 Ves. Jr. 669. So in an action for rent the defense of 26 years' undisturbed possession was interposed by plea and sustained. Baldwin *vs.* Peach, 1 Young & Coll. (Ex. Rep.) 453; Story Eq. Pl., Sec. 814; Cooper's Eq. Pl., 288. In Landsdale *vs.* Smith, 106 U. S., 391, it was held that the defense of laches might be asserted by a demurrer, although it could also be presented by plea or answer.

On the other hand, the trend of modern decisions is against trying causes piecemeal and in favor of relegating defenses which go to the merits to the domain of the answer. Rhode Island *vs.* Massachusetts, 14 Peters, 210,257; Sharp *vs.* Reissner, 9 Fed. Rep., 445; Korn *vs.* Wiebush, 33 Fed. Rep., 50; Bailey *vs.* LeRoy, 2 Ed. Ch. 514. In Walker on Patents the author, at section 507, says "A plea is not appropriate for such a defense (laches), because if the bill shows delay and is silent about excuses therefor, the method of a plea would be to state that there is no such excuse, and because, by taking issue on such plea, and proving an excuse, the complainant could cut off all other defenses, and win the cause." It will be observed that the learned author does not pronounce the plea an improper pleading, but only inappropriate and unwise.

Although no exact precedent has been found, the court is entirely clear, after an extended examination of analogous cases, that this plea was properly filed. By setting it down for argument the complainants have admitted the facts therein alleged to be true. Briefly stated, these facts are that third parties have openly infringed the patents for 11 years with the knowledge of the complainants and their predecessors; that the defendant is not a maker and seller, but only a user of the alleged infringing articles, and has, as the complainants well knew, been using such articles openly and notoriously, for the last 11 years, as a part of the apparatus for lighting its building in New York city; that, although continuously within the jurisdiction of this court and abundantly able to respond in damages, the complainants have never given any notice to the defendant or asserted any claim under either of the letters patent mentioned in the bill.

The question, then, is this: Can a patentee maintain an equity action of infringement against a mere user who has used the patented structure openly for a period of 11 years with the full knowledge of the patentee and without objection from him? It is thought that this question must be answered in the negative. Hammond *vs.* Hopkins, 143 U. S., 224; Galliher *vs.* Caldwell, 145 U. S., 368; Foster *vs.* Railroad Company, 146 U. S., 88; Landsdale *vs.* Smith, 106 U. S., 391; Robinson on Patents, vol. 3, Sec. 1194, and cases cited in Kettle *vs.* Hall, 29 Fed. Rep., 508.

The bill alleges that the defendant has been infringing "ever since the 27th day of December, A. D. 1881." In Brush Electric Company *vs.* Ball Electric Company, 43 Fed. Rep., 899, this court had a similar allegation under consideration and, by implication, decided that a bill, which alleged a continuous infringement for 10 years without excuse, was bad on demurrer. The bill in that case was saved, however, because the word "since" was construed to mean not "ever since," but "subsequently to" the date of the patent.

The case at bar differs, in many respects, from the cases cited in support of the bill, chiefly because it is affirmatively established by the allegations of the plea that the patents were plundered openly and continuously by the public without complaint by the owners of the patent, and that the defendant's alleged infringement was well known to them during 11 years, and was acquiesced in without even a notice to desist. The fact, too, that the defendant is only a user would seem to dispose of the doctrine applicable to a multiplicity of suits, as well as other grounds of equitable cognizance.

It must be conceded within all the authorities that, upon the admitted facts here, an accounting, as well as a preliminary injunction, are out of the question, and it is difficult to imagine upon what theory a permanent injunction can issue. The theory of the rule is that, as the defendant has used these fixtures for 11 years with the permission of the complainants, they cannot now complain of their use. If the defendant were making and selling new fixtures, and thus interfering with the complainants' business, the rule might be different, but it would seem that the rights of the parties are fixed and determined as to the structures which the defendant has used so long with the complainants' implied consent. In other words, the complainants can only be injured to the extent of their license fee, and the right to recover that has been lost by their own negligence.

The doctrine of McLean *vs.* Fleming, 96 U. S., 245, and Menendez *vs.* Holt, 128 U. S., 514, 523, is invoked by the complainants. Although both these cases relate to trade-marks, no reason is perceived why the principle there enunciated should not be applicable to patent causes, but it is thought that it is not applicable to facts in hand, for reasons already given.

It was stated at the argument that there was ample excuse for the apparent delay in bringing the action, and that one object in setting the plea down for argument was to have a precedent established by a determination of the question, whether the complainant should allege his excuses for delay in the bill or reply to the allegations of the answer setting up the defense of laches. The court is of the opinion that, even if the complainants are right upon the proposition that the bill in its present form can be sustained for a portion of the relief prayed for, it is much wiser and safer to amend the bill by setting up all the facts upon which they rely. Where the delay appears upon the face of the bill the excuse should appear also.

In Badger *vs.* Badger, 2 Wall, 87, the court says that the complainant in a suit in equity "should set forth in his bill specifically what were the impediments to an earlier prosecution of his claim; how he came to be so long ignorant of his rights, and the means used by the respondent fraudulently to keep him in ignorance, and how and when he first came to a knowledge of the matters alleged in his bill; otherwise the chancellor may justly refuse to consider his case, on his showing, without inquiry whether there is a demurrer or formal plea of the statute of limitations contained in the answer." It is thought, therefore, that the plea must be allowed, but with leave to the complainants to amend their bill within twenty days.

Mr. Eugene H. Lewis, counsel for the complainants, will file an amended bill within the 20 days.

A European Long Distance Telephone Line.

One of the longest European telephone lines which is now in operation is that between Vienna and Trieste, a distance of 506 kilometers or 314 22 miles. This line consists of four sections:

1. The line within the city proper, five kilometers. 2. The line between Vienna and Mürzzuschlag, 99 kilometers. 3. The line from Mürzzuschlag to Jasounik, 256 kilometers. 4. The line from Jasounik to Trieste, 146 kilometers.

The line was built under the supervision of the technical staff of the Austrian Telegraph Administration, and every source of disturbance to the telephone service has been carefully avoided. A bronze wire of four millimetres diameter serves as conductor between the various cities, while one of three millimetres is employed within them. The 16 kilometers of line between Senosec and Sessana required unusual care in its construction, that section being noted for its severe "bora-storms." To avoid all trouble, the engineers decided to use a four millimetres compound wire, with transpositions at each 16th post. From most accurate measurements made by the technical staff, it appears that the total resistance of the line between Vienna and Trieste is 2,099 ohms, or 2 ohms per kilometer, while the insulation resistance per kilometer of conductor varies according to the atmosphere conditions between 50 and 66 megohms. The capacity of the entire line is stated to be 4.4 to 4.7 microfarads. The central exchange at Prague serves as the center of the line. Up to the present, telephonic communication has only been opened between the several principal exchanges, all of which use the new Deckert and Homolka microphone, well known on account of its excellent qualities. As soon as these powerful instruments have been supplied to private subscribers, they will be able to converse from their residences with any exchange subscribers of the various cities.

In the "Berliner" suit, brought by the United States Government against the Bell Telephone Company for the repeal of the Berliner patent, Mr. Causten Browne, of Boston, has been retained by the government to assist the prosecution. The defendant's answer was filed on the first inst., and the government should regularly make its reply by the first Monday in June.

Exhibit of the Belknap Motor Company at the World's Fair.

The Belknap Motor Company, of Portland, Me., has an exhibit at the World's Fair, an illustration of which is shown herewith.

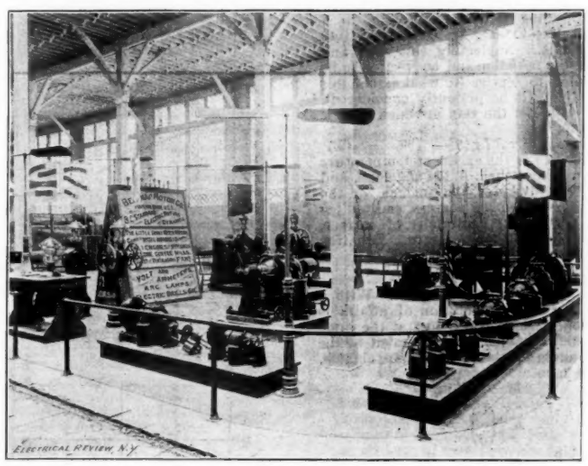
In November, 1889, the Belknap Motor Company was organized with a capital of $50,000, and had its headquarters at 24 Plum street, in Portland.

In March, 1892, the business of the company had increased to such an extent that its officers decided to manufacture its own goods, all the machines up to this date having been built by Megquier & Jones and the Giant Electric Motor Company. The business of the previous year had amounted to about $14,000, and steps were at once taken to push it in every direction. The business increased to $34,000 the next year.

This steady increase necessitated the procuring of additional floor space, and the company now has a plant 40x65 feet, two stories high. A large amount of new machinery has been placed in the factory, and the company is in a condition to keep up with the orders, for a time at least.

The company makes a specialty of the B. C. standard dynamos and electric motors. Of the electric motors 16 grades are manufactured, ranging from one-eighth of a horse-power to 40 horse-power.

The B. C. standard dynamos are built in 13 grades, ranging from five lights to 500 lights. These motors and dynamos are among the best in the market, and their strong points have attracted the attention of leading dealers in the country.



THE BELKNAP MOTOR COMPANY'S WORLD'S FAIR EXHIBIT.

Another specialty is the new electric and water motor cyclone coffee mill. The cyclone is a well made machine, the grinding parts being of the finest on the market. The electric motor is one horse-power and will grind from three to six pounds of coffee per minute. These mills were given the highest award at the Mechanics' Fair, in Boston. There are eight different styles.

The company also manufactures the combined water motor and dynamo, seven different water motors, the combined engine and dynamo, the combined electric motor and exhaust fan, besides electrical supplies and construction work.

W. H. Chapman is the electrician, and he has designed some of the finest machines in the "B. C. Standard." All of the work in its various stages is carried on in a most systematic manner, every man before he strikes a blow being given a printed copy of the original drawings and specifications, thus insuring uniform results.

The company has placed on exhibition in Space 2, Section E, Electrical Department at the World's Fair, 26 of these machines. It is confidently expected that the results of this year's business will reach the large figures of $100,000.

The submarine cable to the Isle of Shoals, costing $12,000, is now being laid and will be finished by July 1. Summer visitors to the Shoals will appreciate the advantages of this cable.

Annual Meeting of the American Institute of Electrical Engineers.

On Tuesday, May 16, the Electrical Engineers held their annual meeting for the reception of the yearly reports and the election of officers.

After the usual routine of business, the list of candidates for the offices the terms of whose incumbents had expired. These officers were as follows: Frank J. Sprague, president; Thomas D. Lockwood, Carl Hering, William J. Hammer, vice-presidents; J. C. Chamberlain, P. B. Delany, Horatio A. Foster, H. Ward Leonard, managers; George M. Phelps, treasurer; Ralph W. Pope, secretary.

The recommendation of the council was as follows:

For president, Thomas D. Lockwood.

For vice-presidents, H. Ward Leonard, P. B. Delaney, William Wallace.

For managers, Charles Hewitt, Harris J. Ryan, William J. Hammer, J. J. Carty.

For treasurer, George M. Phelps.

For secretary, Ralph W. Pope.

The entire ticket, with the exception of Mr. Lockwood, was elected, Prof. Edward J. Houston receiving the office of president for the next year.

The general meeting was held at the headquarters of the Institute, 12 West Thirty-first street, on Wednesday, May 17.

The morning session of the general meeting for the reading and discussion of papers and reports was called to order at 10 o'clock. The following papers were read:

1. "On the Behavior of Fuse Metals in Direct and Alternate Current Circuits," by Mr. Charles P. Matthews, of Cornell University, Ithaca, N. Y.

2. "A Modified Deprez-D'Arsonval Galvanometer," by Lieut. Charles D. Parkhurst, of Watervliet Arsenal, West Troy, N. Y.

3. "The Variation in Economy of the Steam Engine Due to Variation in Load," by Prof. R. C. Carpenter, of Cornell University, Ithaca, N. Y.

4. "An Automatic Printing Speed Counter for Dynamo Shafting," by Prof. George S. Moler, of Cornell University, Ithaca, N. Y.

At the conclusion of this session a recess was taken, and then the second part of the day's programme was enjoyed by the members.

Dr. M. I. Pupin, of Columbia College, New York city, delivered an entertaining lecture upon the "Practical Aspects of Electrical Resonance."

In the evening many of the members of the Institute accepted the invitation of the New York Electrical Society to attend a lecture in Columbia College, by Dr. E. J. Morton, entitled "A Brief Glance at Electricity in Medicine." Tickets to the Urania Theatre were distributed after the lecture, and an invitation was given to examine the electrical devices used in this wonderful production.

Messrs. Crocker and Wheeler requested the pleasure of the attendance of the members of both societies at their works, in Ampere, N. J., on Thursday afternoon, May 18.

Death of Walter T. Glover.

We regret to announce the death on the 27th ult., after a long illness, of Mr. Walter T. Glover, senior partner in the firm of Walter T. Glover & Company, of the Salford Electric Wire Works, Springfield Lane Cable Works and Bridgewater Street Iron Works, all situated in Salford, England. The business was established in 1868 by the deceased gentleman, and continued under his sole management until 1887, when he was joined in partnership by Mr. Henry Edmunds, of London. Up to the present time it has steadily advanced, and is now regarded as amongst the most progressive houses connected with electrical industry. Mr. Glover patented many specialties in connection with insulated wire and cables, and likewise improved braid and twine machinery. His decease will in no way alter the firm of W. T. Glover & Company, but the business will be carried on uninterruptedly by the surviving partner, Mr. Henry Edmunds.

The Action of Continuous and Alternating Currents on Fuse Metals.*

READ AT THE TENTH GENERAL MEETING OF THE AMERICAN INSTITUTE OF ELECTRICAL ENGINEERS, NEW YORK, MAY 17, 1893,

BY C. P. MATTHEWS.

For the protection of electric circuits from the passage and consequent heating effects of currents of abnormal intensities, no device is in more general use than the so-called safety fuse. Commercially the fuse appears in a variety of connecting devices and inclosing boxes, classed as thermal "cut-outs,"

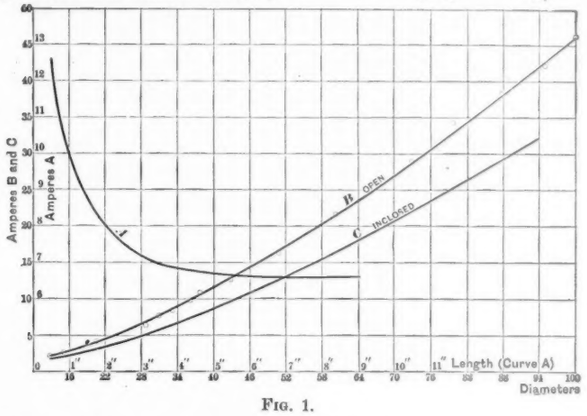


FIG. 1.

and familiar to all having to deal with the distribution of electric energy. The protective element in all such consists of a wire or strip of some easily fusible metal of such current carrying capacity that it will melt under the heat developed by an excessive current. In points of simplicity, cheapness, ease of adjustment and low resistance, the safety-fuse possesses advantages over most, if not all, electro-magnetic safety devices. Experience shows, however, that unless certain conditions for successful working are carefully observed, the safety fuse may fall far short of furnishing satisfactory and reliable protection.

With a view of studying these conditions, and of obtaining at the same time reliable data on the fusion of conductors under circumstances closely approximating those of actual practice, a series of experiments, some of the results of which appear in this paper, were recently made in the Physical Laboratories at Cornell University.

This experimental work, which was undertaken by several persons, may with propriety be divided as follows:

Part I. On the behavior of various alloys under the action of direct currents, with special reference to their use in thermal cut-outs.

Part II. On the *disintegrating* effect of the alternate current on fuse metals.

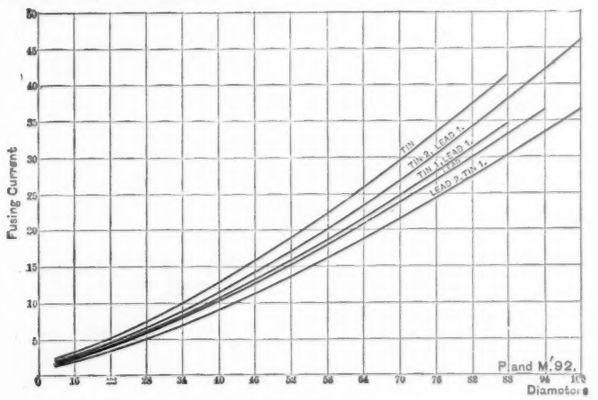


FIG. 2.

PART I.

The first experimental work of any extent on the electric fusion of wires was performed by W. H. Preece, F. R. S., in 1884.† He showed that the relation between diameter and fusing current is parabolic,‡ being

$$C = a\, d^{\frac{3}{2}},$$

where a is a constant for any given metal or alloy. This relation is obtained as follows:

The rate at which heat is developed by a current C flowing in a wire of resistance R is

$$H = \frac{C^2 R}{J}$$

in thermal measure. The resistance of the wire may be expressed in terms of its dimensions and the specific resistance ρ of the material thus:

$$R = \rho \frac{l}{\frac{1}{4}\pi d^2}.$$

By substitution,

$$H = C^2 \frac{4\rho l}{J \pi d^2} = K l \left(\frac{C}{d}\right)^2. \qquad (1.)$$

Now, as the temperature rises, there are heat losses by radiation and by convection into the surrounding medium, and also, to a greater or less extent, by conduction into the terminals. Neglecting this last, and assuming the radiation and convection to be proportional to service (to what extent this is justifiable will be presently considered), we may write for the rate at which heat is thrown off

$$H' = \pi d l \varepsilon (T - T^1), \qquad (2.)$$

where $T - T^1$ is the excess of temperature of the wire above that of the envelope, and ε is the emissivity of the surface, or the number of water-gram degrees emitted per second, per square centimetre of surface, per degree rise of temperature. Equation (2) may be written

$$H = K' d l$$

for any permanent temperature. With a constant current a condition of affairs is soon reached when heat is lost at the same rate as that at which it is generated by the current, and a constant temperature obtains. We then have

$$H = H', \text{ or}$$

$$K l \left(\frac{C}{d}\right)^2 = K' l d,$$

from which

$$C = a\, d^{\frac{3}{2}},$$

where

$$a = \sqrt{\frac{K}{K'}} = \sqrt{\frac{\pi^2 J \varepsilon T}{4\rho}}.$$

This result shows the fusing current to be independent of the length of the conductor. Evidently a is the current necessary to fuse a wire of unit diameter. The emissivity is here assumed to be a constant quantity for a given surface. The valuable experiences of Kennelly on the "Heating of Conductors by Electric Currents," in which the radiation and convection losses were separated, and the results of Ayrton and Kilgour, indicate that such is not strictly the case. These latter investigators found that for any temperature the emissivity is the higher, the finer the wire. The rapidity with which fine wires heat and cool is a matter of common observation. Mr. Kennelly's results indicate that the convection is proportional to the temperature elevation for small differences of temperature, and that, moreover, losses occurring in this way increase slightly with the diameter, and are dependent on the form of the conductor. For the purposes of calculation of the fusing currents of wires, however, it is sufficient—as both the results of these investigations and those of Mr. Preece show—to consider only the total heat loss, and to assume the emissivity a quantity independent of the diameter and temperature elevation.

Mr. Preece's first experiments with platinum wires of small diameter do not appear to confirm the foregoing relation. He says: "Platinum wires—especially those of small diameter—are liable to flaws which practically reduce their effective diameter to a great extent; and also the larger wires, from their greater weight, necessarily tend to part asunder at a lower temperature than those which are lighter, and in which the strain is less."

In 1887 Mr. Preece presented the results of an elaborate series of experiments on wires of different metals, showing that the theoretical relation is quite strictly borne out in experiment, except for wires of extremely small diameters. The following year "final and corrected" values of a were announced for the following metals:

Copper, 10,244; Aluminium, 7,585; Platinum, 5,172; German silver, 5,280; Platinoid, 4,750; Iron, 3,148; Tin, 1,642; Alloy (Tin, 1, Lead, 2), 1,318; Lead, 1,379.

In determining these constants, Preece used six-inch lengths of wire, while to ascertain the value of the same metals as cut-outs one and one-quarter inch lengths were used. It will be noticed that a value of a is given for only one alloy of lead and tin. In the course of the experiments of which this paper treats, a redetermination was made for lead and for tin, and at the same time values of the constants were determined for various alloys of these metals. These latter are, it is believed, now announced for the first time. These metals were dealt with especially, because of their extended use in the manufacture of fuse wires.

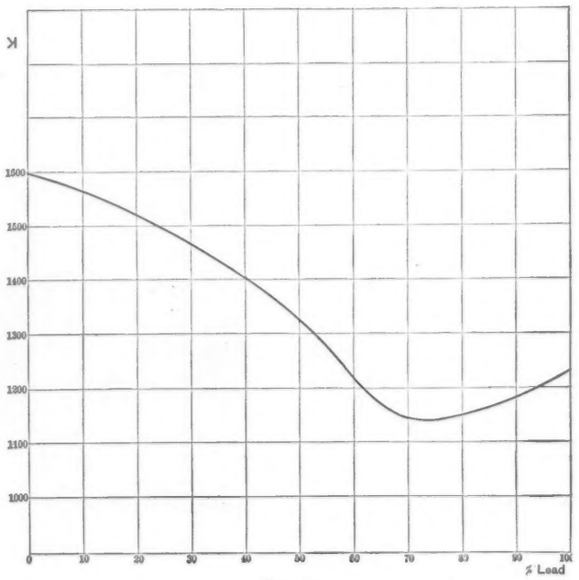


FIG. 3.

To determine to what extent the fusing current is influenced by the cooling effect of the terminals, pieces of wire of given diameter and composition, but of varying lengths were successively tested. The marked variation in current is shown graphically in Fig. 1, Curve A. It will be noted that while an eight inch piece fused at 6.6 amperes, a half-inch piece of the same wire carried 12.5 amperes, or an excess of nearly 100 per cent. before yielding. For lengths of this wire greater than six inches the conduction losses are practically *nil* in their influence on the value of the fusing current. The reader is referred to a formula deduced by Lord Kelvin for the loss of heat occurring in this way. The practical point to be observed at this juncture would seem to be this: manufacturers cannot accurately rate their fuse wire unless the length of the specimem to be used is specified. In the fuse blocks in common use it is impracticable to use extreme lengths, yet if three inch pieces were used, the cooling effect would not be serious. Fuse-blocks are on the market employing from one-half inch to three inch lengths of wire and all the variation indicated by the curve may be expected.

In the experiments to determine a for alloys of lead and tin, ordinary commercial metals were used, for, although the fusing current is affected by the presence of impurities, yet it was considered better to experiment with such grades of metal as would be used in practice. The alloys were cast in the form of cylindrical slugs, and these were drawn into wires varying in diameter from 10 to 100 mils. These were tested with great care. A Thomson graded ammeter was used to measure the current, the instrument being frequently calibrated during the work. For varying the current strength, a liquid resistance was used. The box containing the electrolyte was provided with a sliding contact, such that the current could be increased or decreased continuously without break or undue fluctuation.

There is an important time element to be considered in connection with the phenomena of fusion. A certain interval elapses before the wire reaches the permanent temperature corresponding to a definite current. The duration of the current in this portion of the work was 60 seconds, experience showing that if a wire of moderate diameter did not fuse in that time under the action of a certain current it would not fuse at all. Curves A′ and B′ of Fig. 5 illustrate the magnitude of this effect in a particular case, the time intervals being as 1:2. The variation in fusing current exceeds five amperes for the larger sizes. It should be noted in this connection that unless massive terminals are used they may themselves become heated, thereby checking the flow of heat through the ends of the wire, and tending to promote ultimate fusion.

The limits of this paper do not allow the insertion of the complete data on these alloys. The curves of Fig. 1 (B and C), however, may be taken as representative, and indicate that the "three-halves power law" was quite closely followed, a result which was obtained in all the other cases. From each observation of current and diameter a value of the quantity a was computed; the mean of these values was taken, and a curve of calculated fusing currents drawn for each alloy. These curves appear in Fig. 2. It will be noted that while the temperature of fusion of tin is considerably lower than that of lead, its *fusing current* is about 24 per cent. higher. This is undoubtedly due to the difference in the resistance of the two metals. The specific resistance of tin is 13,360; that of lead 19,487 (C. G. S.). There is possibly also some difference in the emissivities of the two surfaces. Curve C, Fig. 1, illustrates the effect of enclosing the fusible wire in glass tubes. As would be expected, the convection is thereby checked, and the fusing current very appreciably lowered. This is a point which should not be overlooked in practice, that is to say, the nature of the fuse-block, whether closed or open, should be considered.

The constants obtained were:

Alloys.	Per cent. Lead.	a	Preece's Constant.
Tin.....	0	1592	1642
Tin 2, Lead 1...	33.3	1441	
Tin 1, Lead 1...	50	1328	
Tin 1, Lead 2...	66.6	1156	1318
Tin 1, Lead 4...	80	1131	
Lead.....	100	1283	1379

Plotting these constants as ordinates, with per cent. of lead as abscissæ, the curve shown in Fig. 3 was obtained. From this curve the constant for any alloy of lead and

*1. An abstract of two theses, viz.: "Safety-fuses for Electric Circuits," by J. S. Peck and C. P. Matthews; and "The Action of Alternating Currents on Fuses," by W. S. Rugg and C. R. Sturdevant.

†1. "On the Heating Effects of Electric Currents," Proc. Roy. Soc., April 3, 1884.

‡2. This law had been previously enunciated by Prof. Forbes before the British Association in 1882. (See Rept. B. A.) See also paper by same author, Jour. Soc. Telegraph Engineers, xiii, 236.

TABLE A.

DATA FOR FIG. 4.

Rating.	Diameter.	2 in. piece Current.	½ in. piece Current.	⅛ in. piece in Fuse Block.
1	.0149	4	5.37	12.03
3	.020	5.72	9.9	17.68
5	.0305	9.65	23.4	32.16
7	.0351	12.76	27.5	35.37
10	.0395	15.78		

tin whatsoever may be taken, and the current necessary to fuse a wire of any diameter readily calculated:

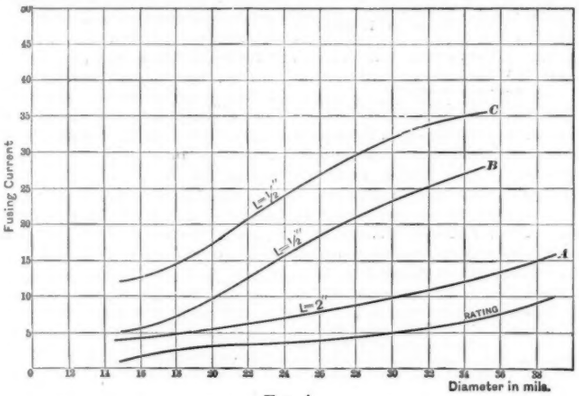


FIG. 4.

Attention is called to the fact that those values of a which may be considered as redeterminations are all lower than the values announced by Mr. Preece in 1888.

Comment on this fact is made in the original report in the following words: "Had they been higher, we should have ascribed the difference to the fact of our using wires of shorter lengths. As it is, we can only say that Mr. Preece, doubtless, experimented with chemically pure metals, while our wire was drawn from the commercial article. He gradually increased the current until fusion occurred; we endeavored to find *what current, when it had plenty of time to bring about a permanent state, would fuse the wire.* In increasing the current continuously from zero to that which melts the wire, there is danger of getting too high current readings. Mr. Preece's first determinations were entirely too high, as his later investigations show."

TABLE B.

DATA FOR FIG. 5.

Rating.	Diameter.	Current.	
		10 Seconds.	20 Seconds.
1	.0155	3.08	2.93
2	.0248	6.20	5.64
5	.0374	12.6	10.81
10	.0533	21.24	18.29
20	.0804	42.61	36.18

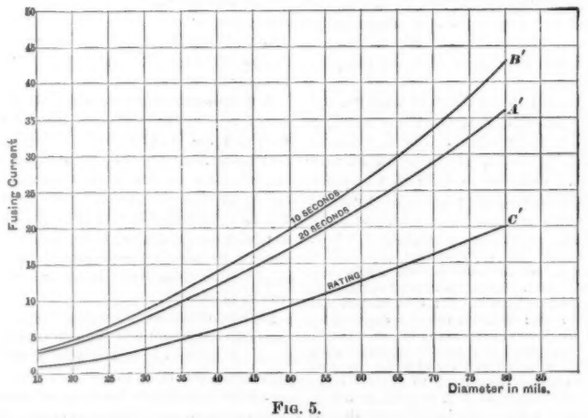


FIG. 5.

In order to ascertain the status of marketable fuse wire, a number of samples were obtained from different manufacturers and tested under conditions similar to those already described. The results were represented graphically by curves, only two sets of which are here reproduced. In Fig. 4, curve A, is that obtained where two inch specimens were tested, and, as will be seen, is not far from a three-half power curve. When, however, one-half inch pieces of the same wire were tested, curve B, much higher and distorted, was obtained. The marked cooling effect of the terminals is here apparent. Curve C is the most remarkable of all. One-half inch lengths of the same sizes of wire were successively fused in a porcelain ceiling cut-out block. This block was so constructed that the wire came in contact, throughout its length, with the cooling surface of the porcelain. The heat was conducted away so rapidly that the current reached the abnormal values shown, before rupture occurred. For example, a seven ampere fuse did not "blow" until more than 35 amperes were flowing in the circuit. Curves A′, B′ and C′ in Fig. 5 represent the behavior of the best sample of wire tested. This wire was quite uniform in diameter, and gave evidence of careful rating. The curve of rating should be of the same general equation as that of fusion, since both represent isothermal conditions.

The requirements for an efficient safety fuse may be summed up as follows:

1. Promptness of action.
2. Low fusing point.
3. Permanency under normal conditions.
4. Moderately low resistance.
5. Firm and lasting contact.

Promptness of action requires that the temperature of fusion should not be too far removed from that attained when the wire is being worked at its rated capacity. Moreover, it is important that the metal should not undergo chemical changes produced by the action of the heat which may appreciably alter its melting point. The formation of oxides may or may not promote prompt fusion. In the case of pure tin and some of its alloys, a coating of oxide is often formed which retains the molten metal some time after the temperature of fusion has been passed, ultimate rupture usually occurring with considerable violence. On the contrary, the rapid oxidation of iron and copper wires seems to favor prompt fusion.

The question of low fusing point is one with which the fire underwriters are concerned, since wires fusing at high temperatures introduce an element of danger from fire. With fuses enclosed in properly constructed blocks, the danger from this source is not great, and the necessity of employing a metal of low melting point is not so important as might be imagined. Experience shows that fuses made of nearly all the metals available for such purposes will melt without dangerous scattering of particles or liberation of hot gases when the current is gradually increased until the break occurs. This, however, is a condition which rarely obtains in practice. Mr. Preece experimented with various metals to determine their behavior on short circuit. He made for each metal a verbal description of the character of its fusion, such as: "Scintillating particles flew in all directions to a great distance." His results are unique and comprehensive as regards the variety of metals experimented with, but suffer from the inadequacy of the English language to express with proper shading the nature and degree of the disturbance in each case. The author of this memoir hit upon the plan of surrounding the fuse with a paper cylinder about 3⅛ inches in diameter and 10 inches in length, and then exploding the fuse by an excess of current. In this way a series of autographic records were obtained, showing with considerable accuracy what happened in each case. These records are perhaps more curious than valuable, but they are undeniably interesting, and it is to be regretted that some of them cannot be reproduced here. Owing to the cylindrical form of the paper, the particles of molten metal striking it, in any way but normally, traced out sinusoidal curves of continually decreasing amplitude. The vapors liberated colored the paper quite beautifully in many cases, and usually in characteristic tints, while an idea of the temperature attained was given by the degree to which the paper was burned. In most cases when half inch pieces were used, an arc was established across the terminals, the intense heat of which was far more destructive than anything resulting from the temperature of the metal. The reader is referred to the original thesis* for these curious records, as well as for much other matter pertaining to a subject which, it is believed, is too liable to be regarded of trivial importance.

PART II.

What has been said in Part I will doubtless apply equally well to fuses on either direct or alternating current circuits, but in the latter case a new and annoying phenomenon, well worthy a special investigation, confronts the electrician. Reference is had to the subtle effect of the alternating current on fuse metals, by reason of which they often yield when carrying currents well within their rated capacities. This phenomenon was mentioned in the editorial columns of the New York *Electrical Engineer* of September 16, 1891. Referring to a paper previously read before the Providence Convention of the Electric Light Association, the following words were used:

"Perhaps the most important (point) was the nature of the fuses employed in the alternating current system, and the difficulties which accompany their use, as described by several members. It would thus seem that the action of the alternating current has a disintegrating effect upon the fuses, which causes them to 'blow' after comparatively short use, and thus necessitating a constant renewal and supervision of the circuits."

The discussion following the paper above mentioned showed that this trouble had been experienced by many, and the hope was expressed that a careful investigation of the matter should be made. To cite a particular case: In the lighting system of the Cornell University Library eight 50-volt circuits were supplied with fresh fuses and a record kept of their behavior for a period of three months. During this time it was found necessary to furnish six of the circuits with new fuses, one circuit requiring three such renewals. In this last case the fuse was badly corroded, owing to water dripping from the floor above. The others were in dry and airy places, the contact being bright and firm. One of the fuses had the appearance of being simply cut, the opening being so narrow as to require close examination to detect it.

In their attempts to study this peculiar effect of the alternating current, the chief difficulty encountered by the experimenters was the fact that their reports had to be submitted in a comparatively short time. The subject is peculiarly one requiring long periods, in which the action, whatever its nature, may proceed far enough to yield results of definite and quantitative value.

For the purpose of systematic investigation it was assumed that the effects of the current might be one or more of the following:

(*a*) A change in the resistance of the metal. It was thought that this would likely be a rise, with a result of lowering the value of the fusing current.

(*b*) A change in the physical properties of the metal. It was thought possible that a molecular change, such as crystallization, might take place, caused by alternate contraction and expansion from the heating effects of a varying current.

(*c*) Poor contact. This might be due to the loosening of the binding screws or other holding device, because of the frequent alternations. Imperfect contact due to electrolytic action would be more likely to occur with direct than with alternating currents.

(*d*) The effect of the current upon various metals and alloys was thought likely to be different, and, consequently, some alloys might be of just the right composition to overcome most of the difficulties mentioned.

The following results deal particularly with and tend to corroborate the first and second assumptions.

Samples of wire of various rated capacities were obtained from four different manufacturers (hereafter designated by I, ii, iii and iv), and of this wire, 14 pieces were chosen for use in the tests. The sizes and disposition of these several wires were as tabulated:

No.	Make.	Rated Capacity.	(Cms.) Length.	(Cms.) Diameter.	(Sq. Cms.) Area.	(Legal Ohms) Resist.	(Microhms) Specific Resist.
1	I	2	188	.0633	.00316	1.276	21.4
2	"	2	105	.0476	.00178	.8727	14.76
3	"	3	99.5	.0377	.00112	.7781	13.5
4	"	5	179.3	.057	.00256	.7193	13.2
5	"	10	98.1	.0824	.00534	.3420	19.39
6	"	18	106.5	.1224	.01172	.3336	19.76
7	iii	18	178	.1585	.0197	.1153	19.76
8	"	18	70.4	.1585	.0197	.0249	19.76
9	"	18	118	.1585	.0197	.0756	19.76
10	iv	18	114	.1585	.0197	.0674	19.76
11	"	18	129.2	.1585	.0197	.0674	19.76
12	"	18	126	.1585	.0197	.0766	19.76
13	"	25	194	.1918	.0287	.0666	12.55
14	"	25	240	.1918	.0287	.0916	12.55

There is some difficulty in accurately measuring the diameter of a wire of soft material. The foregoing values were obtained from a large number of measurements, the variation being never greater than two per cent., and this very seldom. Pieces of wire from each sample, varying in length from two to ten feet, were wound into helices and mounted on wooden blocks. The ends were soldered to copper terminals of negligible resistance, the metal itself being used as a solder, and resin as a flux. The joints were allowed to stand at least 24 hours before any measurements of resistance were taken. For the determinations of resistance a "fall of potential" method was chosen as being best adapted to these small values. The standards used were a one ohm coil standardized at the Cavendish laboratory in 1885, and a smaller compensated resistance composed of copper and carbon, accurately tested and compared with the standard coil.

After the fuses were mounted, as above described, their resistances were found, and they were placed on the circuits available in the laboratory, as follows:

Nos. 1 to 6, inclusive, Alternating $\sim = 250$.
" 7 " 9, " " $\sim = 132$.
" 10 " 14, " Direct ——

These fuses were subjected to the action of the current for periods ranging from 88 to 487 hours, this variation being due to the fact that the circuits were used intermittently for lighting and for general laboratory purposes. From time to time additional resistance measurements were made. In the original report the change in resistance is exhibited graphically by means of curves. These curves are so widely different in form that their interpretation becomes a difficult matter, and the determination of any law impossible. They indicate, however, that a distinct rise in resistance occurred in all of the fuses on alternating circuits, except No. 6, which shows a somewhat anomalous behavior. The maximum rise occurred in the case of No. 8, amounting to 29.6 per cent. in 105 hours. Of the fuses on direct current circuits, all but one showed a slight decrease in resistance, the maximum change being only 3.5 per cent. The figures for each specimen appear in a succeeding table.

That some molecular change actually took place was shown in the following way: It being practically impossible to test wires of so soft material for tensile strength, it was considered best to subject them to an alternate torsional stress of a given amount, continuing the alternations and noting the number until the specimen gave away. A simple piece of apparatus was constructed for this purpose, and it did its work very well. Twenty pieces of each of the 14 specimens were tested in this way. Ten of these had been subjected to current action, and 10 had not. The change in brittleness in the case of the fuses which had been on alternating circuits was quite marked, being in no case less than seven per cent.; while the change in those which had been on direct circuits was, with one exception, negligible. These results, together with some data on the fusing points before and after the passage of the currents, are given in the subjoined table:

(*Continued on page 184.*)

* In Cornell University Library. T 1893. 216.

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We sincerely regret to learn that such serious charges as allowing an outside party to copy pending applications in the United States Patent Office have been brought against ex-Commissioner Wm. E. Simonds. The situation is a grave one, and for the good of inventors and the honor of the Patent Office nothing but a most searching investigation will suffice.

AN INCREASE IN INSURANCE RATES.

If wires carrying heavy currents were protected by an insulating compound, material or conduit, as should be ordered and insisted upon by the underwriters, there would be few, if any, fires resulting therefrom. The Pittsburgh Fire Underwriters have taken a step in this matter, but, it would appear, in the wrong direction. Instead of seeing that the protective covering is improved and absolutely perfect work done, they have ordered a heavy increase on buildings having electric wires running into them, subject to being conditionally waived. The increase for an electric light wire running into a house is 25 cents per $100, and 15 cents for each additional wire. If, however, the wires are fused at their entrance to the buildings this increase is not collected. For telephone or electric call-bell wires running into buildings the increase is 10 cents for each $100 and 5 cents for each additional wire, with some provision as to fusing. An increase of 10 per cent. was added for small buildings occupied as dwellings and partly as stores. All these increases apply to the contents of the buildings as well as to the structures.

As it will be but a short time until every building of any importance will have either a telephone, telegraph or electric light or power wire running into it, it will be seen that this advance in rates means an advance on almost every risk in stores, office buildings and dwelling houses.

Notice what the opening of the World's Fair has done for the West Chicago Street Railway. Advices from Chicago state that the earnings of this road during the first 14 days of May were 20¾ per cent. greater than those of the same time last year; and on the North Chicago Street Railway the increase is 21½ per cent. These figures are significant. Can it be that the murky and dreary days that seem to attach themselves to Chicago once in a while have made the increase less than it should have been? The extra passenger traffic resulting from the increase in traveling population, it would appear, should be much more than a mere 20 per cent. There is some trouble somewhere. Wait and see if 14 days of good weather and a little hurrying in the installation of the exhibits will not still further improve matters.

POPULARITY OF THE TELEPHONE.

The immense strides made in the popular use of the telephone have been unprecedented in the history of notable inventions. This fact goes as a conclusive argument to prove the need of such an apparatus. In the early days of 1876 and 1877 the short telephone lines then in service were but slightly used in business transactions. With the improvements which are the outcome of time and experience the telephone has come to be a necessity upon which the business community has learned to depend to such an extent that its full importance could only be realized were every telephone line thrown out of service.

Stock transactions of great importance, business appointments, the transmission of important news, comprise but a very few of the uses to which telephone service between Portland, Maine, and Milwaukee, Wis., can be called upon to perform.

The demands of a growing world necessitate new uses for the telephone every day. The latest of these is the charging of a jury in Corning, N. Y., by Judge Ramsey who happened to be holding court in Genesee, N. Y. This is the first time a jury has been so charged by any judiciary in the history of the world.

We believe that the majority of business men do not appreciate the full value of telephone service. An appointment for a conversation between New York and Chicago can be made by telegraph and the business transacted within the space of a hundred minutes. We believe that the words used in the advertisements of the American Telephone and Telegraph Company will become historic. They are:

"The mail is quick, the telegraph is quicker, but the long distance telephone is instantaneous and you don't have to wait for an answer."

A METER DISPUTE.

The legal and engineering professions have had another little tilt, and all on account of an Edison electrolytic meter. Lewis Jacobs, a Brooklyn clothier, kicked on the size of the bill the Edison Electric Illuminating Company, of that city, asked him to pay, and he kicked so hard that the company sued him.

Jacobs had 10 arc lights in his store, and his light bill ranged from $11 per month in summer to $65 in winter. The first bill he disputed was for the month ending January 27, 1892. This was for $122.45, with a discount off for the large quantity of electricity used, which brought the net amount down to $97.96. In the month preceding, which included all the busy season just before Christmas, when business was lively and the store was kept open later than ordinarily, Mr. Jacobs says his bill for that month was only $65. He asserted that in January he closed his store every night at six o'clock, and by no possibility could he have used over half as much electricity as in the preceding month. He offered to pay the company $32, which he said was all he owed. The company sued for the full amount, but the jury thought differently, and decided that notwithstanding the meter of the Edison Electric Illuminating Company said that Jacobs used $122.45 worth of electricity in one month, he had really used only $32 worth. The verdict saddled the costs of the suit, amounting to $119, on the company.

During the trial Lawyer Harris, for Jacobs, said an electric light meter was a progressive arithmetical machine, sired by a close corporation and damned by a suffering public. Lawyer Field, for the company, explained that the meter never varied over two per cent., and if any errors occurred, owing to its failure to operate, the margin was in favor of the customer.

The rumor that Clothier Jacobs had christened his meter "Busy Bee," is said to be incorrect.

LETTERS FROM A LABORATORY.—XLVI.

BY JULIAN A. MOSES.

The materials necessary for the construction of impromptu apparatus must, of a necessity, be of such a nature as to be constantly available, inexpensive and readily adaptable to existing needs. Apparatus thus constructed, while it may not possess an ornamental appearance, is useful, which quality should be of the first consideration.

Strong and permanent stands may be made of gas piping, a good supply of which of assorted diameters and lengths may be advantageously kept at hand, for it affords a rigid and satisfactory means of support for shelves, tables, etc. Together with the tubing must be obtained a supply of T pieces, caps, joints, washers and four-way pieces. These should be carefully threaded by some neighboring plumber, who has sets of taps and dies already in use; for to own a set suitable for threading material of such a size as ordinary gas piping, would require quite a little outlay. With an assortment of these connecting pieces and lengths of tubing, which may be bought by the pound and foot, respectively, the experimenter is prepared, with the aid of a very few tools, to construct a number of pieces of inexpensive apparatus, the details of a few of which are as follows:

A blast lamp used for glass blowing would cost, if purchased at a chemist's supply house, about five dollars; while for the moderate amount of less than one dollar, a lamp may be made of gas-tubing, which will prove quite sufficient for all purposes. It consists of a tube about six inches in length screwed into one end of a T piece, while on the other end is fastened a "cap," screwed gas-tight. Through this "cap" should be drilled a hole of sufficient size to allow a small bored brass tube to pass tightly through, to serve as the air supply tube. Through the shorter branch of the T piece must now be inserted another similar tube through another cap to serve as the gas supply tube. The former tube allows the egress of the air to be at the point of the burner, and serves the purpose of the tip of a blow-pipe. This is one simple instance of where the gas piping will save a little expense.

A constant level water-bath, a most useful piece of apparatus in the laboratory, is another that can be easily made of the gas piping, and is just as useful as the more expensive ones. Here by connecting a T piece at the point at which the level of the water in the metallic water-bath is desired, a constant slow stream from the faucet may be admitted, and the superfluous water allowed to flow off through a rubber tube attached to the free and open end.

A most desirable stand to contain a number of shelves for holding bottles and other small articles may be made by having the four uprights of jointed gas tubing; and, at the junctures, the boards should rest so that the holes drilled through the corners will just be of sufficient size to allow the tubing to pass through, but not of a diameter large enough to permit the passage of the couplings, which thus serve as permanent rests for the boards.

Shelves of this nature will withstand considerable strain and will be able to serve as rests for heavy castings and other weighty apparatus, but they should be situated in out-of-the-way places, far from all sensitive galvanometers, etc. The ease with which these shelves may be built recommends them, and unlike other kinds they may be readily separated and as easily reconstructed.

By countersinking a number of holes in the laboratory bench and inserting into each of them a threaded cap, places are thus made so that upright rods may be firmly secured to the bench, thus giving a number of standards to which may be attached, by means of screw clamps or rings, whatever apparatus may be required.

To prevent small pieces of apparatus from disappearing into these openings, it would be well to stop them up with small corks, each having a piece of wire passed through it and turned over on the under side to serve as a handle, and thus allow of its ready removal.

CORRESPONDENCE.

OUR BOSTON LETTER.

The W. S. Hill Electric Company, of this city, have perfected a rotating fan motor which will soon be put on the market. Mr. W. S. Hill, the inventive genius of the company, has been working on this problem for some little time, and his latest production is both novel and unique in design and at the same time extremely simple and efficient in operation. Illustrations and a detailed description of the new motor will appear in our next issue.

The Bill of the Milford and Hopedale Street Railway Company, requesting permission to run their cars on the West End tracks in this city, came up before the Senate on the 17th, having passed the House some days before. After some argument for and against, it was finally resolved that the Senate should visit Milford on the 22d and witness the practical working of the road, after which the question could be decided on its merits.

The Northampton Street Railway Company have been granted permission by the Railroad Commissioners to increase their stock $100,000, and the extra amount has already been subscribed. Work on the new equipment of the line has begun, and will be pushed ahead with all possible speed. A contract for 225 tons of new steel rails has been closed with the Pennsylvania Steel Company, and the contracts for the electrical equipment will be given immediately.

The New Electric Road between Waltham and Watertown was opened recently under very successful auspices, and the residents and property owners along the route and at both terminals left nothing undone to show their appreciation of the enterprise. A very unusual demonstration on the part of the citizens was given as the first car passed over the line. The road certainly fills a long-felt want, and is sure to be well patronized. The line is three miles long, and cost over $100,000 to build and equip.

Further Developments in the incandescent lamp situation may be looked for in the near future. Still another of the old companies who occupied a very prominent position in the field before being closed up by the General Electric Company, and whose sturdy defense on that occasion attracted such wide-spread interest, is about ready to resume the manufacture of lamps, and this time is in no danger of an interruption to its business. As to the detailed construction of their new lamp, I am not yet at liberty to state particulars. Suffice it to say that the new lamp is a good one, and will be heard from in the strongest possible manner within the next 10 days.

There Seems to be some reasonable doubt at present as to whether the State Central Railway Company, of Worcester, Mass., whose plans for an extensive electric system to connect a large number of towns in central Massachusetts were perfected some time ago, and for which they received franchises, will accept the severe conditions imposed upon them by the Marlboro aldermen, which it seems are out of all reason. They are required to pave entire streets which should properly come within the province of the city, and which would put them to an expense of nearly $30,000, to say nothing of being obliged to build a new bridge over the Boston and Albany tracks, which will require a still further heavy outlay. The Consolidated Street Railway Company have accepted conditions imposed upon them which require an expenditure of nearly $100,000 for paving, and the North End Street Railway Company are also laboring under similar conditions. There is no doubt that the towns which would be connected by these systems would be greatly benefited, and the country along the proposed routes rapidly developed by the successful operation of the roads, and it is short-sighted policy on the part of the aldermen to impose conditions which, from their extreme severity, will tend to discourage an enterprise of such magnitude. H. G. T.

Boston, May 20.

The Sawyer-Man Case Again in Court.

It was extensively advertised a few days ago that the Sawyer-Man Electric Company had petitioned the Supreme Court of the United States for a writ of *certiorari* to bring up the record in the case of the Edison Electric Light Company *vs.* the Sawyer-Man Electric Company, in which the Court of Appeals ordered an injunction against the defendant, because of the infringement of the Edison lamp patents. The Supreme Court on May 15 rendered a decision denying the application of the Sawyer-Man Company. This leaves the opinion and injunction of the Court of Appeals against the Sawyer-Man Company, under which name the lamp business of the Westinghouse Electric and Manufacturing Company was conducted, in full force and effect.

The A. I. E. E. Official Badge.

TO THE EDITOR OF ELECTRICAL REVIEW:

The official badge adopted by the American Institute Electrical Engineers embodies the following characteristics:

Franklin's kite, which demonstrated the identity between lighting and electricity, and represents static electricity. It is a recognition of America's first electrician and philosopher, Benjamin Franklin. A diagramatic representation of Wheatstone's bridge, one of the most important pieces of electrical testing apparatus. The galvanometer, another equally important piece of testing apparatus, and which represents magnetism and induction. The amber, of which the galvanometer is made, represents the first conception of electricity, dating back to 600 years B. C., when Thales, the Greek philosopher, recorded the fact that amber, when rubbed, attracted light particles to it, and the Greeks worshipped it, believing the gods had endowed it with life and that it possessed a soul. In 1600 A.D., Dr. Gilbert, court physician to Queen Elizabeth, coined the word electricity from the word elektron, the Greek name for amber. A. I. E. E. represent the initials of the American Institute of Electrical Engineers. $C=\frac{E}{R}$ represents Ohm's law—a fundamental law in electrical work. The pin is made of white enamel, with the lettering and front portions in 18-karat gold, and the back in 14-karat gold. Apply to the secretary, Ralph W. Pope, 12 West Thirty-first street, New York. Price, $3 each. Committee on badge and certificate, Dr. F. Benedict Herzog, Horatio A. Foster, William J. Hammer.

New York, May 16.

PERSONAL.

Mr. Morris J. Hart, an electric railway and lighting magnate of New Orleans, was in New York last week.

Mr. L. S. Dumoulin, recently electrical engineer for the West End Street Railway Company, of Boston, was in New York last week.

Prof. Mascart, of Paris, has been appointed a member of the International Jury for the World's Fair for the section of electricity, representing France.

Mr. Gisbert Kapp, the well-known electrical engineer and author, arrived in Boston last week. Mr. Kapp is making a business and pleasure trip to this country.

Mr. T. W. Sprague, connected with the mining department of the General Electric Company, Boston, was among the out-of-town visitors to New York last week.

M. E. Hospitalier, of Paris, editor-in-chief of *L'Industrie Electrique*, will arrive in America early in July to visit the World's Fair and attend the Congress of Electricians.

Mr. W. C. Dart, of the Rhode Island Tool Company, Providence, R. I., has just returned from Chicago, where he has been installing his company's exhibit at the World's Fair.

Dr. F. A. C. Perrine, who has accepted the professorship of electrical engineering at Leland Stanford, Jr., University, was in New York last week attending the annual meeting of the American Institute of Electrical Engineers.

Mr. H. N. Fenner, treasurer and general manager of the New England Butt Company, Providence, R. I., was in New York last week and visited the ELECTRICAL REVIEW office. Mr. Fenner stated that some of the electrical papers have incorrectly reported the location of his company's World's Fair exhibit. The correct location is Section T, Space 12, Electricity Building.

An Inquiry Answered.

TO THE EDITOR OF ELECTRICAL REVIEW:

In your issue of May 6 I notice on page 147 an inquiry for the proper address of George McC. Brown, formerly of this place. He is now manager of the local telephone exchange at La Salle, Ill.

Yours truly,
LELAND HUME.

Nashville, Tenn., May 16, 1893.

Chicago World's Congress of Electricians.

TO THE EDITOR OF ELECTRICAL REVIEW:

We have the pleasure to announce that in accordance with the expressed wish of the American Branch of the Advisory Council of the World's Congress of Electricians, the Secretary of State has appointed Prof. H. A. Rowland, Johns Hopkins University, Prof. T. C. Mendenhall, Superintendent Standard Weights and Measures, Prof. H. S. Carhart, Michigan University, Prof. Elihu Thomson, Lynn, Mass., and Prof. E. L. Nichols, Cornell University, to sit in the Chamber of Delegates as the duly authorized United States delegates.

While there are many electricians in the United States who could fill with dignity and credit to the profession this honorable and responsible position, yet the profession is to be specially congratulated that the United States is to be represented by men of such high standing, both as gentlemen and members of the profession.

We also have the pleasure to announce that the Royal Commission has named W. H. Preece, Prof. S. P. Thompson, Prof. W. E. Ayrton, Major Cardew and Alexander Siemens as delegates from Great Britain.

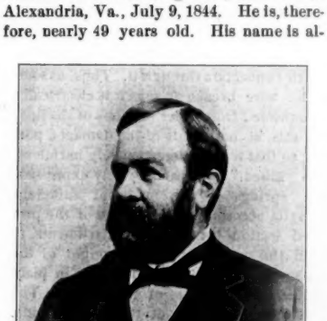
There is every reason to believe that the success of the Congress is now assured, and that all the important countries will be fairly represented.

Sincerely yours,
ELISHA GRAY,
Chairman World's Electrical Congress Committee.

Highland Park, Ill., May 16, 1893.

Prof. Edwin J. Houston, President American Institute of Electrical Engineers.

Prof. Edwin J. Houston, who was last week elected president of the American Institute of Electrical Engineers, was born at Alexandria, Va., July 9, 1844. He is, therefore, nearly 49 years old. His name is almost universally known in connection with his work as a co-laborer with Prof. Elihu Thomson in the development of the Thomson-Houston system of electric lighting. He has also taken out numerous patents for electrical inventions made by him individually, and he acts as an electrical expert in patent cases.



PROF. EDWIN J. HOUSTON.

In 1884 Professor Houston was made a member of the United States Electrical Commission, and the Franklin Institute chose him as chief electrician of its International Electrical Exhibition. He is Professor of Natural Philosophy and Physical Geography in the Central High School of Philadelphia, and Professor of Physics in the Franklin Institute. Professor Houston is the author of several works on geography and chemistry, and he has also written "The Telephone," "Primers of Electricity," "A Dictionary of Electrical Words, Terms and Phrases." He is one of the editors of the *Journal* of the Franklin Institute, and frequently reads papers before that body and the American Institute of Electrical Engineers, besides contributing articles on theoretical and applied electricity to the technical journals.

The Citizens' Electric Street Railway was completed at Muncie, Ind., after just 50 days' work. Five miles of track, with poles, trolley wire and three bridges, spanning White River, have been built in that time, as well as the power house and a brick building which will contain the offices.

Telephone Charges—Sensation vs. Facts.

(From the Financial Gazette.)

The sensational press attacks against telephone charges display an amount of ignorance, wilful or otherwise, hardly conceivable at this time.

To day New York city has the best telephone service in the world—that given by the Metropolitan Telephone and Telegraph Company, of this city—but such service has not been built up in haste, nor has it reached its present state of perfection without the assistance of the ablest scientific counsel and the expenditure of enormous sums of money in carrying out the necessary details to make the Metropolitan Company's telephone what it is to-day, for all commercial purposes—perfect.

To-day the telephone is an essential feature in the financial and commercial world. In Wall street it has been subjected to the severest of tests, and it has triumphed, making its use indispensable in every banker's and broker's office. On a busy day upon the Stock Exchange the telephone plays an important and responsible part. It transmits to the floor of the Stock Exchange buying and selling orders for stocks and bonds amounting in the aggregate, during the five hours of business, to many millions of dollars. It is undoubtedly the most reliable and quickest messenger ever intrusted with trading in securities. It plays the most important part in seven eighths of the brokerage transactions in this city, and will certainly continue to do so as long as common sense holds sway among intelligent business men.

To-day the Metropolitan Telephone and Telegraph Company, with its six local exchanges, gives a splendid service to its subscribers. It has over 9,000 in New York city, and is in connection with direct long distance telephone lines with all leading cities in the States of New York, Pennsylvania, New Jersey, Connecticut, Massachusetts and Rhode Island. All subscribers having metallic circuits and long distance instruments can hold conversation with Chicago, Milwaukee, Boston, etc., demonstrating clearly that no invention of practical utility has been adopted with greater success than the reproduction of the human voice.

The people making the outcry against telephone rents and high charges have but little idea of the cost of telephone service. The Metropolitan Company has one employé for every eight subscribers. This gives some idea of cost of the service, and it should be remembered that a telephone exchange to-day is quite different from one of even two or three years ago. The improvements and the better equipments of the service within the past five years has amounted practically to a complete rebuilding of the system, and such constant changes in improvements for new plant, etc., involves large expenditure of capital.

The Metropolitan Telephone and Telegraph Company is ever ready to give its subscribers the benefits brought about by the introduction of new improvements, as, by increasing the efficiency and the security of its service, it makes its subscribers' interests identical with its own. The company furnishes prompt and efficient connection night and day, work-days and holidays, and, while the service is at the disposal of every subscriber for the entire 24 hours of every day of the year, the greatest demand for the use of the wires is crowded into the hours of 10 A. M. and 4 P. M., requiring special facilities for this maximum period of use. Of course, if the distribution of business was more evenly distributed, such a large outlay for apparatus, trunk wires, operators, etc., would not be necessary.

Those who have carefully examined into the charges of the Metropolitan Telephone and Telegraph Company for its service to its subscribers express the opinion with great confidence that, considering the splendid facilities furnished, with its perfect service and the great expense attendant upon dealing with the problem of furnishing prompt service in a city like New York, the charges by the company are reasonable in the extreme, and that more than seven-eighths of the total subscribers on the roll of the company are not only well satisfied with the service, but are willing to pay the company's charge for same.

As the company pays only about seven per cent. on its capital stock, it cannot be classed as a monopoly, or that its charges are excessive or oppressive.

The executive office is located at 18 Cortland street, and its officers are: Messrs. C. F. Cutler, president; J. H. Cahill, secretary; W. R. Driver, treasurer; U. N. Bethell, acting general manager.

All the above gentlemen are well and favorably known in commercial and financial circles, and that they are alive to the interests of their subscribers is as certain as that the latter, as a body, are only too glad to testify to the excellence of the service they are receiving, and their willingness to pay current charges for the same as long as the present high standard of the company's business is maintained.

THE ACTION OF CONTINUOUS AND ALTERNATING CURRENTS ON FUSE METALS.

(*Continued from page 181.*)

No.	Rated Capacity.	Fusing Current. Before.	Fusing Current. After.	Fusing Current. Per Cent. Change.	Torsion Test. Before.	Torsion Test. After.	Torsion Test. Per Cent.	Hours Run.	Per Cent. Change Resist.
1	2	8.53	8.56	3.06	14.4	10.9	24	487	0.2
2	2	7.90	7.86	1.26	21.6	19.9	7.9	169	0.5
3	3	12.6	12.15	3.56	24.9	13.2	11.14	487	15
4	3	16.46	17.34	2.65	28.7	22.4	21.4	169	0.4
5	5	27.4	25.8	8.35	31.7	16.5	14.8	170	2.0
6	10	52	46.4	10.8	13.3	11.7	13	487	2.0
7	18	52	45.4	11.9	14.8	11	26.4	309	11.3
8	35	52	49.5	4.8	15.2	13.6	10.5	105	29.6
9	18	52			16.9	13.9	17.8	83	3.5
10	10	26.8	26.8	.3	24.1	23.9	.8	170	2.9
11	18	52	51.5	.9	18.6	18.7	.7	309	0.5
12	18	52	51.4	1.1	13.8	12.3	10	296	0.1
13	25	65.06	65.02	.061	11.1	11.0	.9	300	2.3
14	25	65.06	65	.092	11.4	11.3	.8	264	1.5

While these results may be considered as only a beginning along a line of work which is of both theoretical interest and practical value, yet they would seem to warrant the following conclusions:

(1) There is a distinct although irregular rise in the resistance of a fuse on an alternating circuit. (2) This is perhaps to be accounted for by a change in the molecular structure of the metal. (3) This results in a decided lowering of the fusing current in some cases, at least, easily sufficient to affect the reliability of the fuse.

Some Phenomenal Speeds.

"The feat of covering the distance of one mile in 32 seconds by the latest product of our locomotive shops, and the statement that during the run the passengers heard a hum as the wheels passed over the joints in the rails reminds me," said a prominent railway engineer, "of a little yarn I heard the other day.

"A lot of drummers were swapping lies in a smoking car last week, and the conversation had turned on fast traveling.

"'Why,' said one, 'I was on the P. D. and Q. line going from Squedunk to Pushville, and there was a clear line for about 50 miles. Well, it seemed that the engineer was a little late and just let out a little steam to make up time. None of the passengers observed anything remarkable about the movement of the car until I happened to look out of the window, and, bless my soul, if there wasn't a mammoth fine-toothed comb stretched alongside of the track. Just then the conductor came through the car, and I asked him what it was there for. He smiled on me pityingly, and simply said: 'Them's telegraph poles.'

"'Call that fast traveling?' said number two, 'it isn't anything compared with what I saw last year. We were going through some prairie land out West and had a clear stretch of some 300 miles; we were also a little late, and, I tell you, the old engineer began to whiz over that track until the whole country seemed to be converted into a cemetery. Why, the ground was just white with the mile-stones.'

"Then number one handed something to number two, and they both smiled."

Massachusetts Institute of Technology.

Entrance examinations for the first year at the Massachusetts Institute of Technology will be held at the Fifth Avenue Hotel, New York city, on June 29 and 30, 1893, in charge of a member of the faculty. The requirements for admission may be obtained by addressing Mr. H. W. Tyler, secretary, Massachusetts Institute of Technology, Boston.

An Automatic Safety Switch.

The apparatus described as follows and illustrated with the accompanying cuts is the invention of Adelbert E. Hutchins, of Detroit. Many devices for the purpose of signaling a break in a line wire to the central station have been patented, but the following device is interesting as regards the simplicity of construction and the manner in which many accompanying contingencies are met with and possible causes for failure averted.

Of the apparatus A represents a support which may be of any size and shape, and secured in any way. The line or wire B B (see Fig. 1) is connected with pivoted arms C C which, when in place for use, conduct the current the same as if they were a portion of the line. Springs as C^1 C^1 normally draw

Fig. 3.

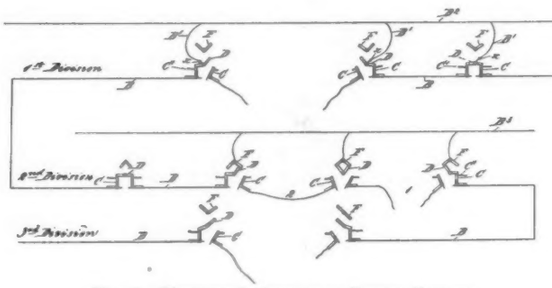


FIG. 3.—HUTCHING'S AUTOMATIC SAFETY SWITCH.

the arms against the tension of the line, which tension ordinarily keeps the arms in working position. The instant that the tension is released by the breaking or sagging of the wire, as on the right of Fig. 1, then the corresponding spring C^1 draws the connected arm C back, and destroys the electric connection through it. That section of the line connected at the right of Fig. 1 leads from the left of the next apparatus in the line wherein the breaking or sagging has produced a corresponding destruction of the electric connection through it. Thus, as soon as the wire breaks or sags it is electrically disconnected from other portions of the line, and this at both ends of the damaged portion, so that it is rendered entirely harmless, or is "killed," as it is commonly expressed. The springs C^1 are made of sufficient strength, according to the length of the protected section between the instruments, to avoid the possibility of the weight of the damaged portion holding the arms in place against the strength of the spring. The arms C are bifurcated at their upper ends, as indicated, and so fashioned as to interlock with the other pivoted arms D to hold the latter down when the arms are in position to allow the current to pass through. A spring D^1 operates to quickly carry arms D up or around their pivots as soon as they are released. In being thus released and then forced to turn upwardly they each pass over a push button E, of any suitable construction, closing that button, which completes a circuit to the station or elsewhere, and thus causes an alarm to be given, or causes other work, as the cutting off of the main current, to be performed. This communication between the apparatus and the station is effected through an auxiliary wire, sections of which are indicated at E^1 E^2 E^3. The auxiliary line is completed through the push button by latches or like devices, as E^4 E^5, which latches may, if desired, be locked out of contact with the push button by pins, as at E^6, as when no signal is to be given.

F F is still another set of pivoted arms, with which the arms D, when raised, may interlock in a manner to form an electric connection. If these are not required they may be keyed up and out of the paths of arms D, as indicated by the dotted lines on the right of Fig. 1, employing pins, as F^1, supplied for the purpose. Suppose the line B to be fed by branches from a main conductor, then damage to a portion of line B, between two branches, will not of itself interrupt all communication with the balance of the system; but, on the other hand, if the line be fed directly, it becomes desirable to provide for the passage of the current beyond the damaged part. To accomplish this what is termed an idle wire may be employed, in case no other wire is convenient of access. The idle wire is connected with the apparatus at a point, as G, upon the plate upon which arms F are mounted and with which they are in electric connection. As soon as arms D connect with arms F (which occurs at the instant of breakage or damage), then communication for the current is established through the connected arms and through the idle wire around the damaged section, as will be apparent, leaving the remaining portions safe against the disturbance.

In the first division of Fig. 3 the line B is fed by branches B^1 from a mainline, as B^2, leading to binding posts, as x, and thence communicating with arms C. The arms F in this section are not required, and are, therefore, keyed up as indicated. Breakage of the line in this division causes the connected arms C to fall or recede and the corresponding arms D to rise, the current through line B^2 passing the broken section and proceeding on to the balance of the system.

In the second division of Fig. 3 the line B, continued from first division for convenience, is fed directly. In this case an idle wire B^3 is employed, the same being connected with arms F, shown in working position. A break in this division, or a sag, or both, as at 1 and 2, causes the arms to assume the positions indicated. The current will follow line B to the apparatus at the left of 2, pass on wire B^3 to the apparatus at the right of 1, and thence on to the balance of the system, leaving the damaged parts 1 and 2 perfectly harmless.

From the second division of Fig. 3 the line B continues to the third division, in which it may be a direct feeder, and in which it may be desired to employ the improved apparatus only to render any breakage harmless, the idle wire being then omitted, as indicated.

It is frequently desirable to repair or change portions of the line, and in such cases the apparatus may be set by hand to disunite all that part of the line which is being worked upon—with manifest advantages to the workmen.

In Fig. 1 the sections C^3 over which the trolley may pass are hinged to the transfer arms C, or to the lower jointed sections thereof, and are each supplied with springs, as at C^3, to throw them down whenever the transfer arms are released. These sections C^3 are sustained ordinarily by engagement with stationary hooks, as C^4, from which they are released by being carried forward by the movement of arms C. If allowed to remain in place a current might pass from one to the other, and thus prevent the desired "killing" of the damaged line-section B. The springs C^3 are employed to insure against the possibility of the parts binding by rust or otherwise. The insulated wheel C^5 is located in the line between the hinged sections C^3, so that when the latter are forced forward or toward the center they will come in contact with the wheel, and thus be crowded in an inward direction and the hinge joints loosened, so that the springs C^3 will be enabled to perform their offices.

The upper and lower sections of arms C are connected by flexible pieces C^6, which transfer a portion of the weight of the lower section to the upper, so as to assist the movement of the arm in the direction desired—and being flexible these connecting pieces will bend to admit of the movement of the upper part of the arm in cases in which the lower part is prevented from swinging down, as when the wire simply sags a little but enough to release the arm, or as when no sagging occurs, but the tension is merely diminished.

The following are the claims made by the inventor:

1. In an apparatus of the character herein set forth, the combination, with the arms which are pivoted intermediate of their ends and attached to the electric conductor, of a second set of arms pivoted independently of the first set, upon a single pivot, movable in the same plane as the first set, and held normally in electric contact with the first set by the tension of the conductor, said second set of arms being arranged to turn upon their pivots as soon as disengaged from the first set and to transfer the current to the undisturbed portions of the conductor, substantially in the manner and for the purposes specified.

2. In an apparatus of the character herein specified, the combination with the two sets of independently pivoted arms, one of the sets of said arms being pivoted intermediate of their ends and the other set mounted upon a single pivot, said sets of arms being also movable in the same plane, electrically connected with the electric conductor and with each other, and held in electric contact as explained, of separate springs connected with each set of said arms to force them to turn upon their pivots and to recede from each other at the times and in the manner described.

3. In an apparatus of the character herein set forth, the combination with the pivoted arms C and D, arranged to be held in electric contact as explained, of the arms F connected with an idle wire and adapted to transfer the current from arms C through arms D to said idle wire, substantially as shown and for the purposes set forth.

4. In an apparatus of the character herein set forth, the combination with arms D interlocking with arms C, and normally held in working position thereby, of push buttons for closing an auxiliary circuit, said push buttons being located in the paths of arms D and arranged to be closed by said arms when the latter are released, substantially as shown and for the purposes set forth.

Fig. 1.

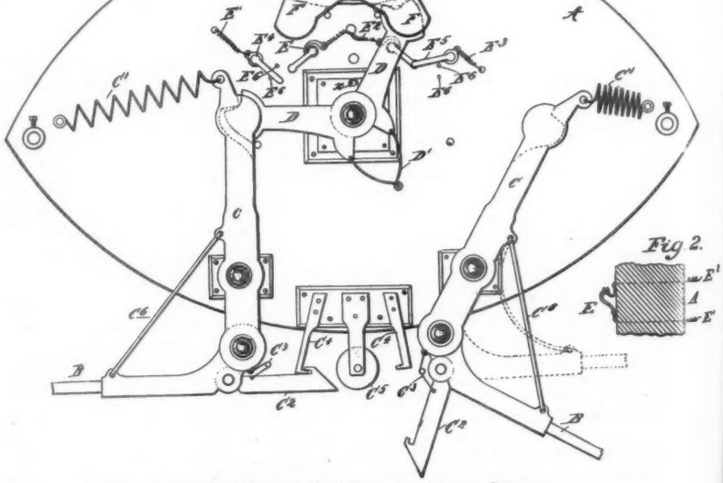


Fig 2.

FIGS. 1 AND 2.—HUTCHING'S AUTOMATIC SAFETY SWITCH.

The So-Called Neutral Wire in Lighting Systems.

An insulated or uninsulated neutral wire—that is the question over which the Berlin Elektrotechnische Society has spent considerable time. On the one hand, Dr. Kallmann, representative of the Allgemeine Elektricitäts Gesellschaft (Berlin), strenuously advocates the use of an uninsulated bus wire in Edison systems. He is well and ably seconded by Dr. O. Fröhlich, one of the engineers of the firm of Siemens & Halske, while, on the other hand, Postal Councillor Wabner and Privy-Postal Councillor Grawinkel, representatives of the German Postal and Telegraph Administration, urge that many of the worst disturbances of the telephone service are directly attributable to the employment of the uninsulated neutral conductor.

Dr. Kallmann and Dr. Fröhlich have separately devised apparatus which permits the electric light people at once to observe an incipient fault in their cables and to locate its position. This is done by laying out the city in sections, and by the introduction of special test conductors running parallel to the mains and branches passing through such sections. At the central these test wires are connected to sensitive relays which, by the fall of their shutters, indicate the presence of a fault.

Dr. Kallmann reaches the conclusion that the potential difference of the earth decreases in proportion to the number of points at which the neutral wire is grounded; in other words, his ideal of an electric light system is an uninsulated bus wire in intimate contact with the earth throughout its entire length, thus reducing the potential difference of the ground to zero, whereby all potential differences appearing in the out and return conductors of the system become direct short circuits.

In answer to Dr. Kallmann's paper, fully illustrated by drawings, which should be carefully studied by all telephone as well as electric light engineers, Mr. Wabner discussed the disadvantages to the telephone service which are attributable to the use of the uninsulated bus conductor. After a few introductory remarks, he pointed out that every experienced telegraph engineer was well aware of the impossibility of maintaining a balance in systems operated on the differential plan. If it be desired to keep the neutral wire in an Edison system at zero potential, each of the mains must supply an exactly equal number of lamps at any given moment, which assumption is out of the question. He then alluded to the fact stated by Postal Councillor Grawinkel that the difference of potential in the so called neutral conductor generally amounted to two per cent. of the entire voltage of the system. Furthermore, Dr. W. Kohlrausch, who has recently made careful measurements at the central lighting station of Altoona, found that currents of two volt tension entered the ground from the supposedly neutral wire, and that they affected injuriously the telephone service of the city. Such currents interfere with the busy tests of the telephone operators, and thereby lead to many complaints on the part of the subscribers, who are prone to ascribe any failure to obtain the desired connection to the laziness or inattention of the operators. In fact, it might be stated upon good authority that leakage of current of low potential is most embarrassing to the telephone centrals. Again, from the non-neutral condition of the bus conductors, it follows that the lafter is constantly subjected to electrolytic action which, in time, leads to its entire disintegration.

In the further and rather prolonged discussion, Dr. Kallmann stated that Mr. Uppenborn's tests, *i. e.*, that two per cent. of the entire current generally passed through the neutral wire, was erroneous. Judging from the speaker's statement he seemed to assume that, as a rule, the potential of the neutral wire amounted to two volts. This is a mistake; the above mentioned percentage value represents loss of potential in the main conductors, but not at their terminals. On the contrary, supposing that there existed a potential of two volts in the ground, the disturbance to the telephone service would be vastly increased and accentuated. In that case, a large number of shutters at the central stations could not be kept up.

As to the use of the uninsulated neutral conductor, Mr. Grawinkel is altogether too sceptical, in spite of many tests made by the Allgemeine Elektricitäts Gesellschaft at Berlin, and by Dr. Fröhlich at Altoona.

Mere theory cannot decide the question, and the only trustworthy umpire should be practical experience. A careful study of the experiments recently conducted by the Postal Administration, concerning the effects of leakage from the lighting mains or short circuits upon the various telephone exchanges of the city, leads to the conclusion that the results of such tests are unreliable. It would be much more satisfactory to experiment with low voltage leakage currents lasting several minutes, and a current strength ranging from 1 to 150 amperes. From the number of shutters thrown at the several telephone centrals, and the simultaneously measured difference of potential of the earth, a clear conception might be gained as regards the distribution of leakage currents in the ground. An uninsulated neutral wire in electric light systems would be to the advantage of telephone subscribers.

Shall We Have a National Telegraph System?

The above pertinent question has often been asked but not often satisfactorily answered. A matter such as the governmental control of large industries may be viewed from many directions, and the answer by the New York *Sun* that accompanies this inquiry shows in a forceful manner a very decided view of the subject:

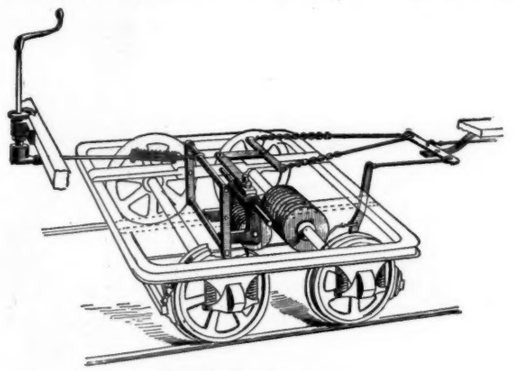
> Will you please give us the *Sun's* opinion as to whether or not a national telegraph is compatible with the principles of Jeffersonian Democracy?
> Boston, May 10. B.

It is not compatible. Centralization has gone too far already. A government telegraph system would open the way for a government telephone system, government savings banks, a government express system, Government control of the railroads, government milk delivery, government abattoirs, cemeteries, dispensaries, lying-in hospitals, and undertaking establishments. If one, why not another; why not all? Jeffersonian Democracy resists every step toward the absorption of all powers by the Federal government. That means State socialism, disintegration, and sure destruction. Home rule and the least amount of government possible, are the fundamental articles of its faith. If Jeffersonian Democracy weakens in this respect, Heaven help the United States of America!

The Elliott Car Brake.

While some of the newer forms of car brakes are in many respects better than the one at present generally used, they are often too complicated, too expensive, or are liable to get out of order. Simplicity and reliability are the features most to be desired and least often found; but given the need, and there is always the inventive ability to provide the desired article.

The brake invented by Mr. G. R. Elliott, of Boston, Mass., is the embodiment of simplicity and efficiency, and is constructed on mechanical principles which seem to be positive in their results. A chilled iron cylinder, having a screw thread cut upon the surface, is firmly fixed upon the axle of one pair of wheels of the truck of a car; a like cylinder, of smaller dimensions, is hung in bearings at the lower end of a lever frame in such a manner as to bring it parallel to that upon the axle. The fulcrum of this lever frame is an iron rod having loose bearings in the woodwork of the truck frame, and with this rod the lever frame carrying the smaller screw cylinder reciprocates.



THE ELLIOTT CAR BRAKE.

To the upper end of the lever frame is attached the rod leading to the brake handle, which rod is divided and has a spiral spring interposed at the junction in such a manner as to make the pull of the brake elastic. A half turn of the brake handle draws this rod forward, causing the lower part of the lever frame, which bears the small screw cylinder, to move toward the larger screw cylinder fixed upon the axle of the wheels with which it engages, and by which it and the lever frame carrying it are moved toward one side or the other of the car, according to the direction in which the latter is moving. A link-arm, one end of which is attached to the lever frame, and which, moving with it, is connected by its other end to the end of one arm of a three-armed rocking lever, fulcrumed at the junction of its three arms and operating in such a manner that whichever direction the lever frame takes, by reason of its small screw cylinder engaging with the screw cylinder on the axle, the three-armed rocking lever will be moved so as to cause one of two links connecting two of its arms to an ordinary straight lever at one end of the truck frame to draw inward, thus causing the other end of the last mentioned lever to move outward, carrying with it the rod connecting it with the beams of the brake shoes, and thus bringing the brake shoes against the tread of the wheels against the stress of springs, which withdraw the shoes the instant the brake handle is released.

A very slight turn of the brake handle will bring the screw cylinders into engagement, and the smaller cylinder will immediately begin to move in a direction at right angles to the length of the car and parallel to the axis of the axle upon which the fixed screw cylinder is located, and it will continue to move in this direction until the strain upon the brakes exceeds the pressure exerted upon the brake handle, when it will disengage and fly back toward its former position, engaging again instantly, the excessive pressure ceases, and repeating this action until the car stops. This is accomplished so rapidly that the effect upon the car is the same as would result from a continuous pressure of the brake shoes against the wheels, yet the several pressures have the effect of destroying the sudden jerk resulting from the locking of the wheels, and, while avoiding the friction and consequent flattening of the peripheries of the latter, is none the less effectual in bringing the car to a stop.

In one end of the rod forming the fulcrum of the lever frame carrying the small screw cylinder is fixed a pin which reciprocates with the rod and causes an angular three-armed rocking lever, in the crotch of which it plays, to throw to one side or the other, according to the direction of its movement and that of the rod from which it projects.

The angular rocking lever is attached by one of its arms and a link to a similar lever of a "T" shape, the latter in turn operating an arm arranged above a rheostat. The rheostat also has an arm against one side of which the last mentioned arm is pressed when going in the direction to cut off the current when the brakes are put on; but when the brakes are released the rheostat arm is left turned so that the motorman must by the ordinary means within his control turn on the current to start.

It will thus be seen that while putting on the brakes turns off the current, throwing off the brakes does not turn on the current, but leaves the car at a standstill until the motorman chooses to start it, when the brakes are in a position not to retard its progress.

It is obvious that, with the parts for governing the electric current left off, this brake is as well adapted for horse cars as for those operated for electricity.

Considering the fact that the greatest power necessary under any circumstances only requires that the brake handle be turned one-half of a revolution, it is clear that the action of the brakes is almost if not quite instantaneous, and that its lack of the rigid characteristics of the ordinary brakes makes the wear upon the wheels uniform, thus prolonging their life and usefulness.

It will also be seen that all the parts are simple and inexpensive, and calculated to wear as long as those now in use.

THE HAMMOND CLEAT.

The New "Hammond" Cleat.

One of the latest additions to the electrical fraternity in Boston is the Hammond Cleat and Insulator Company, of No. 220 Devonshire street, who have just brought out a new porcelain cleat for which they claim many advantages, and which is illustrated herewith.

The fact that the Board of Underwriters, of Boston, have condemned the use of wooden cleats entirely for exposed wiring makes the present a most favorable time for the introduction of a cleat having the salient features of the "Hammond," and there is no doubt but that it will meet with a ready sale.

Its extreme simplicity and the ease with which it is adjusted to any style of work are two strong points in its favor, and the low cost is another.

It is made in one piece of the finest glazed porcelain, and, while it holds the wire firmly, offers no possibility of injury to the insulation, and consequently greatly lessens the liability of breaks from this cause.

It is made in various sizes and for either one, two or three wires, as desired.

The company are now ready to fill orders, and will furnish samples and full particulars upon application.

Wall Street and the Electrical Stock Market.

The market during the week has had a decidedly better tone, and has worked into much more favorable condition. Nevertheless, it is still quiet and hesitating. As features of the week may be cited a general cessation of liquidation and a pronounced covering movement by the short interest. There remains a considerable short interest, which it is believed will be covered next week. The covering put prices up materially. A very determined, although quiet, buying for investment account had the same tendency, and, as a result, the values were much higher at the close of the week than at its beginning. The bear news of the first of the month has given place to that of a bullish character. Thus, the crop advices from the West make a much better showing. The Colorado rate war, which at one time threatened the harmony of the entire Western Passenger Association, has been settled by a restoration of rates. It is believed that the worst of the Australian Bank troubles have been experienced, while the crash in Western institutions of our own country has passed through its worst phases. It is argued, and with logic, that these failures will be a good thing for our finances, inasmuch as they will weed out the weak and "rotten" institutions that are always a menace to conservative business communities. As discouraging features may be cited the continued exports of gold, which this week amounted to $5,000,900, liquidation on the London Stock Exchange, and a general distrust throughout the country in regard to financial institutions and securities, which it will take considerable time to dispel. The failures for the week aggregated 255, as compared with 219 last week and 156 in the corresponding week of last year.

Now that the smoke of battle has cleared, it is possible to take an inventory of its effects upon the electrical stocks. In the following paragraph will be found a comparative table of prices of to-day and five weeks ago of the electric lighting, telegraph and telephone stocks. A perusal of the same demonstrates the fact that, while the tendency of prices on this date is lower, only the active stocks of the list show any marked decline. This demonstrates conclusively my repeated statements to the effect that the inactive stocks of the better class are all very closely held, while those of the poorer variety are almost totally neglected by buyers. It also indicates that the decline in electrical securities was not caused by any condition directly affecting them as a class, but by general market conditions, which carried down the values of those which were the most active. Thus, Edison Electric Illuminating, of New York, lost 12 points in the five weeks, General Electric 28, American Telegraph & Cable 8, Western Union 10, American Bell Telephone 6. It is pretty safe to conclude that a stock which passed through the panic with little or no loss in values is a good investment, and we respectfully direct the attention of investors to those of that class. The table follows:

	April 16.		May 21.	
Electric Light.	Bid.	Asked.	Bid.	Asked.
Con. Electric Storage..	2	3	2	3
Edison Ill., N. Y.....	125½	126½	113	113
Edison, Ill., Brooklyn..	108	110	....	....
" " Boston....	150	150½	144¾	145
Ft. Wayne Elec. (par 25)	12¾	13½	10	10½
General Electric.....	106¾	107⅛	78	78¼
Mt. Conduit & Ins.....	63	65	....	....
Edison Phon. Toy Co..	20¢	30¢	20	30
Thom.-Houston, Series C, (par 10).....	7¾	8	6¾	7
Thom.-Houston, Series D.....	7½	7¾	6	6½
	April 15.			
Thomson-Houston Int.	242	250	242	250
" " Pfd.	105	108	105	108
Thom.-Houston Welding Co.....	59¾	60	59	60
Western El. L. Consol., (par 50)	36	36½	24	24½
Western El. L. Consol., Pfd. (par 50).....	48¾	49	42	42½
Telegraph.				
American Tel. & Cable..	88½	90	80	83
Cent. & So. Amer. Cable..	....	115	....	115
Commercial Cable.....	140	170	135	170
Franklin Cable.....	38	42	35	40
Gold & Stock.....	....	103	100	103
Mexican.....	....	200	....	200
Northwest Guar. (par 50)	104	....	104½	....
Pacific and Atlantic.....	50	60	50	60
Postal Telegraph Cable..	....	80	....	75
Southern & Atlan. (par 25)	78	80	75	82½
Western Union.....	94½	95	85¾	86
Telephone.				
American Bell Tel.....	189½	190	183½	184
Erie.....	45½	46	44	45
Mexican (par 10).....	105¢	110¢	100¢	105¢
New York & New Jersey	95½	97½	92½	95
New England	55¾	56	55	56
Tropical (par 10).....	5¢	10¢	....	10¢

The annual meeting of the Westinghouse Company was held in Pittsburgh this week. It resulted in a re-election of the board of directors and an adoption of the annual report published in our last number. An officer of the company informs me that the new incandescent lamp is now thoroughly on the market, and is receiving a very heavy sale. The output at present is 5,000 per day, and will be increased to 20,000 within a month's time. The General Electric people have not yet commenced their threatened suit for infringement. My informant says that the Westinghouse Company believes that the lamp is not an infringement, and that it holds a club over the incandescent lamp business. The stock of the company has declined materially in the Boston market, for it is the most active, closing at 28 bid and 30 asked.

The course of General Electric has been upward during the entire week. It started at 72½, reached 80 to-day, reacted and closed at 78 to-day. The advance was partially due to a pronounced covering of shorts, which is a good indicative of higher values to come, and moderate buying by moneyed interests. I hear a less bearish talk concerning the property, although there are very few who are bullish upon it.

North American stock displayed signs of activity. This was due to buying on the belief that Mr. Villard would either voluntarily relinquish his management of the company or be forced to do so. Mr. Villard and associates by no means hold a control of the stock, and independent holders have appointed a committee, headed by Mr. Henry Clews, to solicit proxies to be used at the annual meeting to oust the Villard management. A similar movement was attempted last year, without success. The value of the stock is said to be worth nearly double its present selling price, which is 9¾ to 10¾. A few years ago it sold at 64. The company is of the nature of a trust institution, holding considerable stocks and bonds of the Northern Pacific, Wisconsin Central and Chicago Pacific Belt Line Railroad, and a control of the Milwaukee Lighting and Power Plant and an extensive lighting and power system in Cincinnati.

As was expected, West End Electric, of Boston, has reduced its dividend from 10 per cent. to 8 per cent. For April the company showed net earnings of $174,693. The figures per mile are as follows:

	Cents.
General expenses	02.16
Maintenance tracks and buildings	01.38
Maintenance equipment	01.71
Transportation, including danger	11.09
Motive power	07.88
Total expenses	24.22
Net earnings	11.53
Earnings per revenue car mile	35.85
Revenue car mileage	1,500,765

New York, May 20.

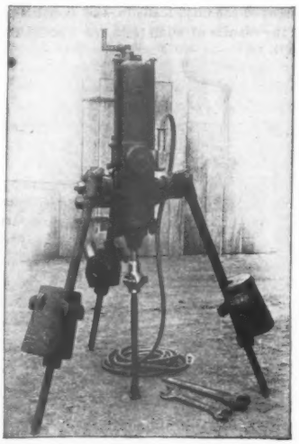


FIG. 1.—GENERAL ELECTRIC COMPANY'S ELECTRIC PERCUSSION DRILL.

New York Electrical Society.

At the last meeting of the season of the New York Electrical Society, held at Columbia College on May 17, Dr. William J. Morton delivered a lecture entitled "A Brief Glance at Electricity in Medicine."

The subject was treated under the following heads: Section I.—The Various Currents Used in Medicine. Section II.—The Properties and Applications of the Respective Currents. Section III.—High Frequency, High Potential Currents. Electrostatics or Franklinism. *A.* Tesla Currents, from alternators, air-gap, condensers, and induction coil; *B.* Morton Currents, from influence machine, air-gap and condensers; *C.* D'Arsonval Currents: Sinusoidal Currents, from alternating dynamo machines.

The lecture was illustrated by experiments, showing the methods of application with the aid of the influence machine.

Telegraph Note.

The telegraphers on the Chicago and Northwestern Road are becoming uneasy, and say the officials of the road are endeavoring to force out all men belonging to the Order of Railway Telegraphers. Last week Superintendent Lawson took two new men to Evanston, Ill., and requested the tower operators at that point to instruct them about their duties, but the operators refused, and quit work. The officials admit that they are working in new men, but say that they need more men.

An Interesting Electric Drill Plant.

The electric percussion drill since it was first put into practical operation has undergone many changes, each tending toward perfection, until to-day it can compete successfully either with the steam or compressed air drill.

One of the most interesting percussion drill plants is that in operation at the lime stone quarries of the Solvay Process Company, near Syracuse, N. Y. This plant has now been working continuously for several months, and the excellent results obtained, both in amount of work done by the drills and the convenience and economy of their operation and maintenance, have given thorough satisfaction to the company first undertaking their general employment. Installed by the General Electric Company at the commencement of the past winter, the drills have operated without any interruption from the intense cold, and have practically demonstrated the advantages derivable from the use of electricity in quarry work. Had steam been the only available power, the loss in transmission by condensation at 20 degrees below zero would have been so great that the drills could not have been worked. The quarry, as will be seen from the cut, is situated in a desolate spot on an elevated plateau, where the intense cold found full scope for action.

At the present time three "Type E" General Electric Company's drills are in continuous operation 10 hours per day, drilling holes from 6 to 10 feet in depth, and 2 to 2½ inches in diameter at the top. The rate of drilling, according to the record kept by the superintendent, is from 45 to 75 feet per 10 hours, averaging 50 feet per day, or 1,500 feet per month of 30 days. The average distance of the drills from the power station is about 2,000 feet at the present time, the circuit, three lines of bare No. 0 copper wire, being extended to a distance of 3,000 to 3,500 feet from the power station in one direction.

The manipulation of the drill is in every respect as simple as that of the steam or air drill, stopping and starting being accomplished by merely throwing a handle to the right or to the left, making or breaking the contact between the cable and the terminals of the coils. Not the slightest difficulty is experienced in lubricating the wearing parts or in handling the drill.

The general dimensions of the "Type E" drills, three of which are doing all the deep hole drilling for the quarry, are: Length over all, 49 inches; outside diameter, wrought iron tube, 7⅛ inches; length of stroke, 5 to 7 inches; blows per minute, 380.

The generator which supplies the power is of the bipolar type running at normal speed, and is provided with a device for directing the current alternately into the upper and lower coils of the drills. The difference of potential at the fixed brushes of the generator is 240 to 250 volts. The generator is belted to a 9x12 inch Straight Line engine, supplied with steam at 90 pounds pressure from a horizontal tubular boiler, fuel for which is brought for three miles over the cable way in the buckets used to transport the lime rock from the quarry to the works. As yet no estimate of cost of repairs can be given, because up to date there have not been any. Should, however, any part break down it can instantly be replaced, as all the parts are interchangeable. The plant has aroused widespread interest among quarry operators in general, and has been visited and carefully inspected by many less prone to reject the good things which advance science offers. That electricity is the ideal power for mine and quarry operation, only the most conservative refuse to believe.

FIGS. 2, 3 AND 4.—VIEWS AT THE LIME STONE QUARRIES OF THE SOLVAY PROCESS COMPANY, SYRACUSE, N. Y., OPERATED BY GENERAL ELECTRIC COMPANY'S ELECTRIC PERCUSSION DRILLS.

ADVANCE INFORMATION.

New Electric Companies Formed and Important Constructions Projected.

VALUABLE INFORMATION FOR MANUFACTURERS AND DEALERS.

We publish below the earliest information obtainable relating to new electric railways, new electric light companies and projected electric construction of all kinds. Every reader will find these columns of special interest, and manufacturers and supply houses will receive many valuable suggestions looking to new business by carefully watching this department in the ELECTRICAL REVIEW from week to week:

New Electric Railways.

PHILADELPHIA, PA.—Old York Road Passenger Railway Company; capital, $15,000. Incorporators, Jno. A. Rig, H. C. Murphy, Wilson Sailer and McClellen Huch, all of Philadelphia.

PHILADELPHIA, PA.—The Philadelphia and Rosemount Passenger Railway Company; length six miles; capital, $100,000. Promoters, Geo. A. Cook, P. W. Smith, Ephriam Allison and Jno. C. Lynch, of Philadelphia.

MECHANICSVILLE, N. Y.—The Stillwater and Mechanicsville Street Railway Company has increased its capital to $60,000, and will change its motive power from horse to electricity.

ALLENTOWN, PA.—The Philadelphia and Allentown Electric Trunk Line Company has awarded the contract for the construction of the line between Allentown and Hullertown, a distance of 17 miles, to J. M. Silverman and W. A. Stern, of Philadelphia. The price is $300,000.

FORT WORTH, TEX.—The project for an electric railroad between Fort Worth and Dallas, 28 miles, is given a solid basis by the reorganization of the Dallas and Oak Cliff Road, and within six months trains will be running between the two cities.

DANSVILLE, N. Y.—The Dansville Electric Railway Company has been incorporated, with a capital of $50,000, for the purpose of constructing an electric railway, three miles in length, in Dansville.

SEA ISLE CITY, N. J.—J. J. Burleigh will look over the ground and decide on the advisability of building an electric line along the ocean front from Corson's to Townsend's Inlet.

STOWE, PA.—An electric railway will be built from Stowe to Black Bear Inn, *via* Birdsboro.

COLUMBUS, GA.—The Columbus Railroad Company will expend $200,000 in equipping its lines with the overhead trolley system.

KNIGHTSTOWN, IND.—A company has been organized to build an electric railway from Newcastle to Knightstown.

CIRCLEVILLE, O.—The Kingston, Hallsville and Adelphi Railway, a steam line, will soon be converted into an electric road.

BEVERLY, N. J.—Articles of incorporation have been filed for a new trolley system to run out of Camden to various parts of the counties of Camden and Burlington. The capital is $3,000,000. The incorporators are Samuel E. Stokes, Charles Tomlinson, John P. Logan and George A. Aldrich, of Philadelphia, and Mitchell B. Perkins, of Beverly.

BUFFALO, N. Y.—The Buffalo, Tonawanda and Sanborn Electric Railway Company. Incorporators, Wilmer Brown, Louis F. W. Arend, Martin F. Meyers, Christian F. Goerss and John H. Bissell.

ALAMEDA, CAL.—The Fernside and Walnut Wharf Street Railroad Company; capital, $25,000. Incorporators, H. Krusi, J. M. McMullin and H. S. Ward.

NEWBURG, N. Y.—An electric railway will be built to Walden.

NORRISTOWN, PA.—The council has granted a franchise to the Chestnut Hill and Norristown Passenger Railway Company.

FREDERICK, MD.—The Frederick and Middletown Valley Passenger Railway Company; capital, $125,000. Incorporators, Dr. M. A. Sharratts, E. L. Miller and G. W. Smith, of Frederick; L. N. Downs, Theodore Bowne and A. L. Norman, of New York. The company will build an electric railway from Frederick to Middletown.

CHICAGO, ILL.—The North Chicago Electric Railway Company; capital, $2,000,000. Incorporators, Charles H. Gurney, John E. Burke and Alexander M. Savage.

WACO, TEX.—The Waco Electric Railway and Light Company has increased its capital to $300,000.

HAVERHILL, MASS.—It is reported that a new electric company is to be formed in this city, and several well-known business men are said to be among the incorporators.

NORTHAMPTON, MASS.—The railroad commissioners have granted the Northampton Street Railway Company permission to increase its capital $100,000, and the company has decided to begin at once on the new electric railway.

JACKSON, MISS.—W. E. Hayne, of Jackson, and W. R. Gravely, of New Orleans, have been granted a franchise to build an electric street railway in this city.

CLEVELAND, OHIO.—The Cleveland Cable Railway Company and the Woodland Street Railway Company have been consolidated under the name of the Cleveland City Railway Company. A. Hanna, is president; F. De Hass Robison, vice-president, and J. B. Hanna, secretary.

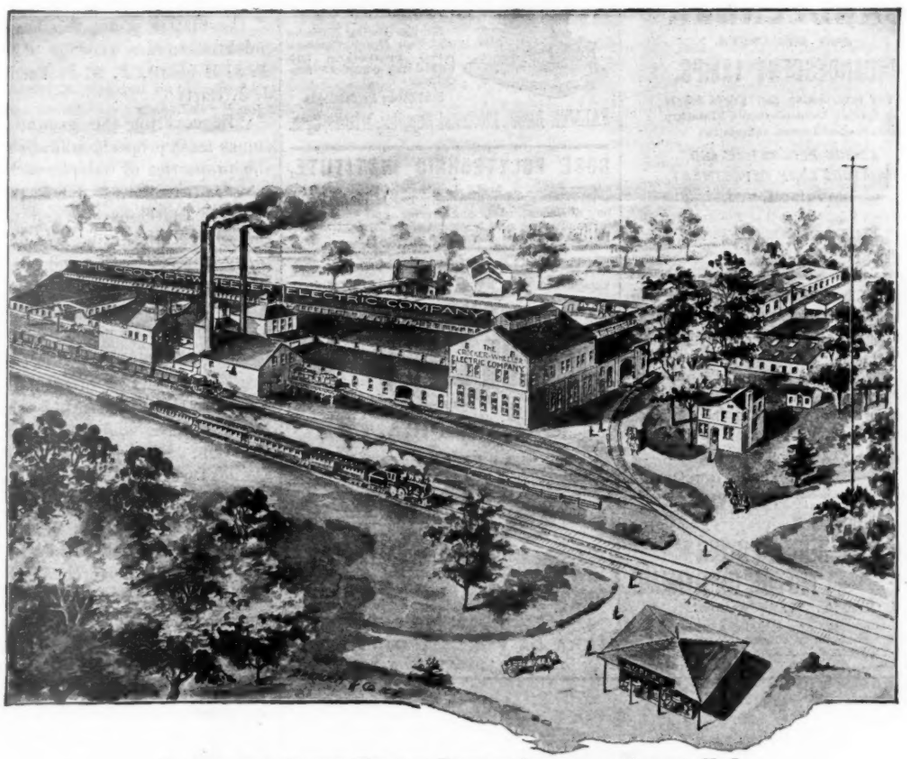
DAYTON, O.—The City Railway Company, capital, $1,500,000, has been incorporated by William H. Simms, J. C. Peirce, Eugene Barney, Charles B. Clegg, Clement J. Ferneding and David B. Corwin. The company is a consolidation of the Dayton Street Railroad Company, the Fifth Street Railway Company and the Dayton and Soldiers' Home Electric Railway Company.

MANCHESTER, N. H.—The Manchester Electric Truck Company; capital, $600,000. Incorporators, Charles T. Means, F. P. Carpenter, David Cross and Aretas Blood.

Electric Light and Power.

ADRIAN, MINN.—At an election held May 8, the proposition to bond the town for the construction of a system of electric lights was carried by a vote of 122 to 76.

WESTBROOK, ME.—A new 1,000 light dynamo is to be put in by the Westbrook Electric Company.



PLANT OF THE CROCKER-WHEELER ELECTRIC COMPANY, AT AMPERE, N. J.

A Visit to Ampere, N. J., the Home of the Crocker-Wheeler Electric Company.

On Thursday, May 18, members of the American Institute of Electrical Engineers and of the New York Electrical Society, together with several ladies, in all about 75, enjoyed a pleasant visit to the works of the Crocker-Wheeler Electric Company at Ampere, N. J.

In a special car provided for the excursionists this good-natured crowd passed over the tracks of the D., L. & W. Railroad, and in 40 minutes from the time they started out, arrived at the new town, a settlement of electrical workers.

It was an especially pleasing trip; everybody seemed to know everybody else and the car presented the appearance of an assembling department in which, at that time, different representatives of particular electrical industries were brought together with a uniform purpose. And here it might be interesting to mention, as a certain gentleman with an open countenance remarked *en route*, that it was the first time he had ever seen an assemblage of electricians with a unanimous definite purpose, outside of the annual clam-gorge offered by Mr. Eugene F. Phillips.

Among the many notables present might be mentioned Prof. R. O. Doremus and Miss Doremus, George A. Hamilton, W. J. Hammer, Francis B. Crocker, Dr. Schuyler S. Wheeler, Charles S. Bradley, C. O. Mailloux, H. Ward Leonard and Ralph W. Pope.

Upon their arrival at Ampere the guests were divided into sections and headed by Messrs. Crocker, Wheeler, Lufkin and other co-workers, the electricians overran the factory.

The special feature of these workshops is the almost entire absence of belting, and consequently but little shafting. Nearly all of the machines are directly connected to independent Crocker-Wheeler motors, the moving parts in the case of drill presses and lathes being but a continuation of the armature shaft of the motor. There was very little noise, but the continual stamp of the presses and the grinding of the heavy iron tools in the engine lathes was sufficient to make everybody abstain from whispering, and give a busy appearance to the very large and roomy shops. Experience has taught the members of this firm that a growing business needs space to grow into, and they have acted accordingly and built shops that will allow of several years' increase in business.

A 90 horse-power Buckeye engine furnishes power for five Crocker-Wheeler multipolar generators, which supply current for all machines and thus substitute for the heavy shafting and ponderous hangers, thin copper wires and graceful porcelain cleats.

Groups of interested spectators examined with interest every minutæ of the shops, and it seemed that the company is very fortunate in having a most industrious set of workmen. An electric traveling crane controlled by suspended cords was exhibited by Dr. Wheeler to the ladies, who with the usual feminine exclamations of admiration, thought it "perfectly lovely."

The testing room was next visited and numbers of motors had their "faces turned towards the wall," humming away for dear life, cooling the brickwork preparatory to their being shipped to the purchasers. Here also was tested one of their large motors, all instruments being specially arranged for portability.

Next to the testing room was the extensive armature winding department. A long row of young workmen, among whom could be seen several college graduates, were patiently winding different sized armatures, and the order that prevails speaks well for the management.

After the inspection the guests were asked to register their names, and in a brief speech, very much to the point, the acting president, Mr. H. Ward Leonard, asked for a vote of thanks to Messrs. Crocker and Wheeler. Professor Doremus made a motion to that effect, and after three cheers and a tiger, the electricians took the 4.47 train to distribute themselves to their respective homes in the great metropolis, thoroughly satisfied with the way in which they had spent their afternoon.

KINDRED INTERESTS

Mr. J. H. Cooke, 437 "The Rookery," Chicago, manager of the Chicago branch of the Buckeye Electric Company, reports that he cannot get enough "Buckeye" lamps to fill orders, the demand being very large in consequence of the recent re-opening of the Buckeye Electric Company's factory.

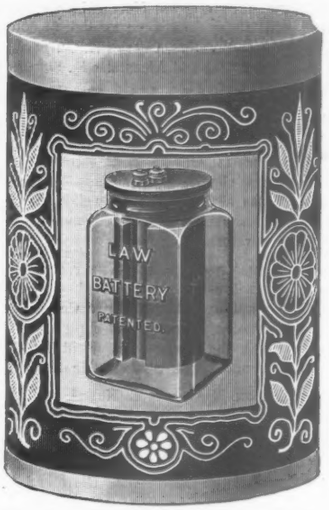
We have had during the past week a touch of summer weather. We are bound to have more, and lots of it. The fan motor will have its innings soon and there will be more of them this year in use than ever before. The Porter Electric Motor Company are good folks to know about now, as they furnish admirable fan outfits of all sizes which give good service, as is instanced by the large number that they are placing on the market. Their office is 62 World building, New York city.

The Stirling Company, manufacturers of water tube boilers, have recently closed the following orders: Cleveland Cable Railway Company, 750 horse power; Lehigh Valley Traction Company, 900 horse-power; Whitman & Barens, for their new Chicago works, 1,000 horse-power; Elmira Knitting Mills, 50 horse-power. They are also installing a large plant for the Union Passenger Railway Company, New York city, and for the Lindell Avenue Railroad, St. Louis, Mo., the latter plant being for 2,600 horse-power. The New York office of the Stirling Company will, in the future, be managed by Mr. Fred. A. Scheffler, and, by carefully bearing customers' interests in mind, it is hoped that business in this section of the country may be largely increased.

A Handsome Specimen of artistic work is the new catalogue of the Interior Conduit and Insulation Company. In addition to a description of the many devices applicable to interior wiring, the catalogue contains complete specifications for the installation of the interior conduit system and also a code for customers who may wish to order by telegraph or cable. The Johnson switch, the Lundell motor and all devices are constructed to conform to standards, and are particularly applicable to the Edison system of distribution. As it is practically impossible to catalogue at any given time all the improvements and new developments, the Interior Conduit and Insulation Company therefore respectfully solicit inquiry as to any device, method, or apparatus which may not appear in the catalogue, before excluding them from the opportunity of supplying the same.

The National Pipe Bending Company, of New Haven, Conn., manufacturers of the National feed water heater, are supplying a great many electric stations, as is shown by the accompanying list of recent sales:

Camden and Atlantic Railroad Co., Atlantic City, N. J., one 600 horse-power; Boston Electric Co., Boston, Mass., tenth order, one 1,000 horse-power; Altoona and Logan Valley Railroad, Altoona, Penn., one 800 horse power; Fowler Car Co., one 250 horse-power; South Carolina Cotton Oil Co., one 200 horse-power; Union Electric Co., Orangeburgh, N. Y., one 500 horse-power; Anderson Water Supply Co., one 100 horse-power; Erie, Penn., one 300 horse-power; North New York Lighting Co., fourth order, one 300 horse-power; Lehigh Traction Co., Hazelton, Penn., one 800 horse-power; Tampa Electric Light Co., Tampa, Fla., one 150 horse-power; Toledo Electric Light Co., one 200 horse-power; Pittsburgh Electric Co., one 300 horse-power; Dover Light and Power Co., Dover, N. H., one 300 horse-power; Whitall, Tatum & Co., Philadelphia, Penn., one 400 horse-power; J. A. Grant & Co., Boston, Mass., one 500 horse-power; Fort Wayne Electric Co., Baton Rouge, La., one 300 horse-power; Lake Roland Electric Railroad, Baltimore, Md., two 700 horse-power; Southern Railway Co., Virginia, one 200 horse-power.



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"I have treated rather fully the questions of interference with the telephone currents from outside sources, especially the troubles from electric railways; for my practice in that direction, during the last four or five years, has been considerable, and enables me to deal with that subject in the light of personal experience. This question is still of considerable importance in this country, and its treatment here may be of assistance to managers of exchanges in practical work.

"It was my intention that the book should be one which would prove useful to the practical man, as well as that it should serve as a basis for a lecture course to students. I have therefore thought it best to introduce some matter in which correct elementary ideas of matter and energy are developed, so as to lead up to the most modern conception of the method of propagation of electro-magnetic disturbances."

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